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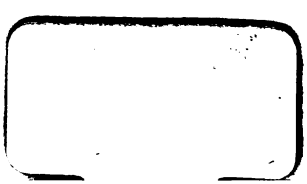


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No. 28.—JULY, 1905

DEPARTMENT OF THE INTERIOR
BUREAU OF GOVERNMENT LABORATORIES

Edgar A. Mearns,

I. THE POLYPODIACEAE OF THE PHILIPPINE ISLANDS

II. NEW SPECIES OF EDIBLE PHILIPPINE FUNGI

BY

EDWIN BINGHAM COPELAND, PH. D.

SYSTEMATIC BOTANIST

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No. 15, 1904, Biological and Serum Laboratories.—Report on Bacillus Violaceus Manilæ: A Pathogenic Micro-organism. By Paul G. Woolley, M. D.

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(Continued on third page of cover.)

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PLATYCERIUM BIFORME (SW.) BLUME. (IN CULTIVATION IN MANILA.)

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No. 28.—JULY, 1905

DEPARTMENT OF THE INTERIOR
BUREAU OF GOVERNMENT LABORATORIES

I. THE POLYPODIACEAE OF THE PHILIPPINE ISLANDS

II. NEW SPECIES OF EDIBLE PHILIPPINE FUNGI

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EDWIN BINGHAM COPELAND, PH. D.

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I. THE POLYPODIACEÆ OF THE PHILIPPINE ISLANDS.

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
BUREAU OF GOVERNMENT LABORATORIES,
OFFICE OF THE SUPERINTENDENT OF LABORATORIES,
Manila, P. I., December 21, 1904.

SIR: I have the honor to transmit herewith and to recommend for publication articles entitled "I. The Polypodiaceæ of the Philippine Islands," and "II. New Species of Edible Philippine Fungi," by Edwin Bingham Copeland, Ph. D., Systematic Botanist.

Very respectfully,

RICHARD P. STRONG,
Director Biological Laboratory,
Acting Superintendent Government Laboratories.

Hon. DEAN C. WORCESTER,
Secretary of the Interior.

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I. THE POLYPODIACEÆ OF THE PHILIPPINE ISLANDS.

INTRODUCTION.

The *Polypodiaceæ* are distinguished from the other orders of true ferns by the character of the sporangium, which is usually stalked and provided with a longitudinal annulus interrupted by the stalk, and opening by a stomium at right angles to the annulus. In the field, and without the use of the microscope, they can be distinguished as a rule from other ferns by the following characteristics:

They are rarely tree ferns, as are *Marattiaceæ* and *Cyatheaceæ*.

They are not filmy in texture, as are *Hymenophyllaceæ*.

They are not dichotomously compound, like most of our *Gleicheniaceæ*.

They do not have climbing fronds, as do most of our *Schizaeaceæ*.

In the Philippines, as elsewhere in the world, the *Polypodiaceæ* are several times more numerous than are all other ferns combined, and, therefore, a treatment of the order does not fall far short of being an entire fern flora.

My attempt has been to collect and publish descriptions of all the ferns known to have been found in these Islands. It is likely that I have fallen considerably short of this goal, for in some groups the discrepancy between my number of species and the larger one given by Underwood[1] is far greater than can be explained by any difference in our interpretation of specific limits. A history of the work on the ferns of these Islands would be superfluous, since the subject has been well handled within the past two years by both Merrill[2] and Underwood.

While I was engaged on this work practically no ferns collected before the American occupation were available for study in Manila.

[1] Underwood, L. M.: A Summary of Our Present Knowledge of the Ferns of the Philippines. Contr. Bot. Dept., Columbia Univ., No. 206, 1903.

[2] Merrill, E. D.: Botanical Work in the Philippines. Bull. (Philippine) Bureau of Agr. No. 4, 1903.

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I am not personally acquainted with a large part of those ferns still known here only from earlier collections and have compiled their descriptions from various sources, especially from the Synopsis Filicum. Of the collections most frequently cited, those of Cuming, Baranda, Steere, Warburg, and Loher are given on the authority of other botanists; while I have at my disposition the collections of Merrill, Elmer, Whitford, Barnes, other collectors employed by the Bureau of Forestry and the Exposition Board, and my own.

Ferns have been among the plants most ill favored by the imposition of plural names, and therefore, in these days of chaos in nomenclature, they present the best of material for jugglery. Not caring to take any part in the strife between the advocates of the different "rules" of nomenclature, I have made it my chief principle to form no new combination of names for any plant which already had, in its proper genus, a name valid under *any* rules. Pending a general agreement among competent botanists, it seems to me that current usage should be the chief criterion in deciding a choice between names. Because their adoption would have compelled me to make new combinations for many species, rather than from any preference for these generic names themselves, I have retained the ones in common use, rather than those taken up by Underwood, for *Gymnopteris, Nephrodium, Hymenolepis,* and *Niphobolus.* Chiefly for the same reason, but in part too because I can not see that the multiplication of genera adds a particle to the naturalness of the presentation, I have maintained as very large genera *Nephrodium, Aspidium, Asplenium,* and *Polypodium.*

It may not be superfluous to add that this Bureau will be very glad to undertake the determination of any ferns which may be sent to it. It is to encourage the interest in our ferns, and in response to very numerous requests for a guide in the determination of the local plants that this paper, our first systematic treatment of any part of the Philippine flora, is published. I take the liberty of copying literally, from Professor Underwood's already mentioned paper, the following directions for the profitable collection of fern specimens:

(1) In all ferns not over 2 feet high an entire plant should be secured, but in plants growing in dense crowns the rootstock may well be split lengthwise and several of the leaves removed before drying.

(2) In all ferns not over 4 feet high an entire leaf should be secured if possible attached to the rootstock or to some portion of it. In case of

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very wide leaves the lower pinnæ on one side may be cut away to prevent the too great massing of foliage when the leaf is doubled on itself to make a manageable specimen.

(3) In tree ferns the basal portion of the petiole should always be secured, if possible, attached to the lower pinnules. Where possible the top of the caudex should also be taken. Notes on the character of the leaf scars should always be made.

(4) If the specimen taken does not show whether the leaves are scattered or cespitose this should always be included in the notes.

(5) In ferns, of whatever size, invariably secure some portion of the rootstock, for it nearly always possesses diagnostic characters.

(6) In large leaves note whether the lowermost pinnæ are larger than the others or are reduced in size and if their laminæ stand in the same plane as the rest of the leaf or are set obliquely.

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POLYPODIACEÆ.

Chiefly perennial plants, rarely annual, and rarely arborescent; leaves (called fronds) with the tissues of flowering plants—epidermal, fibro-vascular, and fundamental; spores borne in stalked sporangia with incomplete longitudinal annulus and transverse stomium.

Families of the Polypodiaceæ.

Stipe not articulate to the rhizome; sorus dorsal on its vein; indusium fastened beneath the sorus on all sides, rupturing irregularly over it (p. 14)	I. WOODSIEÆ
Fronds not articulate to the rhizone; sori dorsal or terminal on their veins, usually round, exceptionally extending along the veins or over the parenchyma; indusia fixed by the center or at the top of a basal sinus, frequently wanting (p. 15)	II. ASPIDIEÆ
Stipe articulate to the rhizome, or not; sori, except in *Oleandra*, terminal on the veins, often on the margin of the frond, and the margin modified in connection with them; indusium opening toward the margin or obliquely, wanting in *Monachosorum* (p. 45)	III. DAVALLIEÆ
Stipe, except in *Stenochlæna*, not articulate to the rizhome; sori superficial, springing from the sides of the fertile veins; indusium opening on the side away from the vein or irregularly in *Allantodia*) or wanting (p. 66)	IV. ASPLENIEÆ
Stipe not articulate to the rhizome; sori near the margin, on the ends of the veins or a strand connecting their ends, protected, except in *Nothochlæna*, by the inflexed and modified margin of the frond (p. 92)	V. PTERIDEÆ
Fronds simple and entire, not articulate to the rhizome; sori marginal or dorsal, linear, usually immersed (p. 106)	VI. VITTARIEÆ
Stipes articulate to the rhizome; sori terminal or dorsal on the veins, usually of definite form and size, without indusia (p. 110)	VII. POLYPODIEÆ
Fronds articulate to the rhizome or not; sporangia covering the fertile surface, without being collected into sori; indusia therefore wanting (p. 136)	VIII. ACHROSTICHEÆ

Artificial key to the families and erratic genera.

1. Sori indefinite, covering the dorsal surface, indusium wanting (*Achrostichum* L.).
   2. Fertile region restricted to specialized apex of simple frond ..... (49) *Hymenolepis*

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2. Fertile region not so restricted.
3. Fronds articulate to rhizome.
4. Fronds pinnate ..... (32) *Stenochlæna*
4. Fronds simple, dichotomous..... (62) *Platycerium*
3. Fronds not articulate to rhizome.
4. Fertile and sterile fronds alike.
5. Fronds simple ..... (59) *Elaphoglossum*
5. Fronds pinnate ..... (60) *Achrostichum*
4. Fronds dimorphous.
5. Veins free ..... (7) *Polybotrya*
5. Veins forming areolæ along main veins ..... (8) *Stenosemia*
5. Veins anastomosing copiously.
6. Sterile frond 2-pronged (61) *Cheiropleuria*
6. Fronds pinnate in plan (9) *Gymnopteris*

1. Sporangia gathered into sori, which are sometimes contiguous, or somewhat indefinite.
2. Sori elongate, not marginal nor sunken.
3. Indusium wanting.
4. Fertile veins oblique to costa.
5. Veins free throughout ..... (23) *Coniogramme*
5. Veins free except near margin ..... (26) *Syngramme*
5. Veins anastomosing copiously.
6. Sori anastomosing ..... (24) *Hemionitis*
6. Sori simple.
7. Stipe not articulate ..... (25) *Loxogramme*
7. Stipe articulate to rhizome ..... (54) *Selliguea*
4. Fertile veins connecting main veins ..... (5) *Meniscium*
4. Sori parallel to costa, one on each side.
5. Frond pinnate ..... (50) *Tœnitis*
5. Frond tripartite ..... (51) *Christopteris*
5. Frond simple and entire..... (52) *Drymoglossum*
3. Indusium present ..... ASPLENIEÆ
2. Sori elongate, sunken, fronds simple and entire ..... VITTARIEÆ *Polypodium elongatum*
2. Sori marginal or submarginal, protected by the inflexed margin of the frond..... PTERIDEÆ
2. Sori marginal or submarginal, apical on their veins, indusium opening toward margin..... DAVALLIEÆ
2. Sori dorsal on the fronds, round or nearly so.
3. Stipe articulate to rhizome, indusium absent ..... POLYPODIEÆ
3. Stipe articulate to rhizome, indusium present ..... DAVALLIEÆ
3. Stipe not articulate to rhizome.
4. Indusium fastened on all sides, rupturing in middle ..... (1) *Diacalpe*
4. Indusium, when present, not fastened on all sides.
5. Veins all free, sori terminal.
6. Pinnæ articulate to rachis ..... (12) *Nephrolepis*

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6. Pinnæ not articulate to rachis.
   7. Indusium attached by base and sides ..... (17) *Microlepia* (15) *Saccoloma*
   7. Indusium fixed by base only, or wanting ..... ASPIDIEÆ
5. Veins free, sori subterminal or dorsal.
   6. Frond quadripinnate, sorus naked ..... (20) *Monachosorum*
   6. Less compound, or with indusium ..... ASPIDIEÆ
5. Veins anastomosing ..... ASPIDIEÆ

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I. WOODSIEÆ.

Stipe not articulate to the rhizome; sorus dorsal on its vein; indusium fastened beneath the sorus on all sides, rupturing irregularly over it.

(1) DIACALPE Blume.

Rhizome erect; fronds large, tripinnate; veins free; sorus usually one to each segment, on the lowest acropetal veinlet; indusium spherical. Two terrestrial ferns, in this part of the world.

(1) **D. aspidioides** Blume. Stipes clustered, erect, 40 cm. high, scaly at the base; frond 25 to 50 cm. high, triangular-ovate; pinnules oblong-cuneate, lobed and more or less decurrent, submembranaceous, glabrescent, or sparsely chaffy on the veins, disposed to blacken in drying.

Mountains of Benguet and Lepanto, not below 2,000 m., *Loher*.

India, southern China, and Malaya.

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II. ASPIDIEÆ.

Fronds not articulate to the rhizome; sori terminal or dorsal on their veins, usually round, exceptionally extending along the veins or over the parenchyma; indusia fixed by the center or at the top of a basal sinus, never elongate, frequently wanting.

Because the presence or absence of the indusium varies within the larger genera, and even in some of their species, no classification and arrangement of the *Aspidieæ* is everywhere easy to use. But, for this reason, any arrangement which tries to define its genera primarily by this character is eminently artificial and impractical.

This is the largest group in our fern flora, and, except for the genera whose sporangia cover the dorsal surface, it is a very natural one, distinguished from the *Polypodieæ* by the nonarticulate stipe and the usually present indusium, from *Asplenieæ* by the round sorus and indusium, and from *Davallieæ* by the latter's mode of attachment.

1. Frond pinnate or pinnately veined.
   2. Sori definite, confined to the veins, fertile fronds or segments not sharply differentiated.
      3. Veins free.
         4. Indusium oval, attached by its axis..... (2) *Didymochlæna*
         4. Indusium orbicular, attached by its center.. (3) *Polystichum*
         4. Indusium cordate-reniform or wanting..... (4) *Lastraea*
      3. Lowest veinlets of neighboring veins uniting to form regular triangular areolæ, usually with a series of regular areolæ outside.
         4. Sori round ..... (4) *Nephrodium*
         4. Sori elongate along the cross-veinlets..... (5) *Meniscium*
      3. Veins anastomosing copiously ..... (6) *Aspidium*
   2. Fronds or their segments dimorphous, sori covering the parenchyma.
      3. Veins free ..... (7) *Polybotrya*
      3. Veins anastomosing.
         4. Veins free toward the margin..... (8) *Stenosemia*
         4. Veins anastomosing throughout ..... (9) *Gymnopteris*
1. Frond and venation dichotomous ..... (10) *Dipteris*

(2) DIDYMOCHLAENA Desvaux.

Fronds at least bipinnate, the basiscopic half of the ultimate divisions almost suppressed; veins free, branched; sori terminal on them but not marginal, somewhat elongate; indusium the shape of the sorus, fixed along the middle, opening on all sides. A single variable species, terrestrial in most tropical countries, resembling a *Lindsaya* more than any of its relatives in *Aspidieæ*.

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(1) **D. iunulata** Desv. Rhizome erect, rising above the ground or not; stipes clustered, fronds 1 to 2 m. high, commonly bipinnate; pinnules almost dimidiate, trapezoidal, the lower margin almost straight, the upper slightly rounded, entire, glabrous, herbaceous; sori 4 to 6 to a pinnule, large, partly immersed.

Luzon, *Cuming* 142, *Steere;* Mount Apo, *DeVore* and *Hoover* 345, common at about 4,500 feet.

Pantropic.

(3) **POLYSTICHUM** Roth.

Fronds at least pinnate, usually tough or rigid, with toothed and spinulose margins and the basiscopic half the less developed; veins free, or in one species anastomosing sparsely and irregularly; sori round, usually dorsal; indusium normally peltate, exceptionally reniform. A reasonably natural genus, but difficult to define because of the many directions in which single species or groups vary; related to both *Nephrodium* and *Aspidium*. Mostly terrestrial.

1. Pinnæ articulate to rachis (*Cyclopeltis*) ..... (1) *P. preslianum*
1. Pinnæ not articulate, veins free (*Eupolystichum*).
  2. Simply pinnate ..... (2) *P. auriculatum*
  2. Lower pinnæ pinnate, sori costal or medial.
    3. Teeth aristate ..... (3) *P. aculeatum*
    3. Teeth blunt or mucronate ..... (4) *P. obtusum*
  2. Lower pinnæ pinnate, sori submarginal ..... (5) *P. amabile*
  2. Lower pinnæ at least bipinnate.
    3. Teeth mucronate or awned.
      4. Lower pinnæ lanceolate-deltoid.
        5. Rhizome creeping ..... (6) *P. aristatum*
        5. Rhizome erect ..... (7) *P. contifolium*
      4. Pinnæ linear ..... (8) *P. horizontale*
    3. Teeth awnless ..... (9) *P. varium*
1. Pinnæ not articulate, veins inclined to anastomose toward the margin ..... (10) *P. falcatum*

(1) **P. preslianum** (J. Sm.) Moore. Rhizome creeping or oblique, short, densely fibrillose; stipes clustered, 3 to 10 cm. high, naked or nearly so; frond 20 to 40 cm. high, 8 to 10 cm. broad, simply pinnate; pinnæ jointed to the rhizome, broadly lanceolate, obscurely crenate, almost horizontal, acute, cordate on the lower and truncate on the upper side at the base, coriaceous, glabrous; veins forked about three times, the lower branches falling short of the margin; sori in 1 to 3 rows on each side of the costa, the costal row the most constantly complete.

Masbate and Catanduanes, *Baranda;* Tayabas, *Merrill* 3351.

Malaya.

A species very near this, but with thinner foliage and the pinnæ not articulate to the rachis, occurs in Luzon and Mindanao, and probably throughout the Archipelago; the two are decidedly too alike for me to separate them generically, by recognizing J. Smith's *Cyclopeltis*.

(2) **P. auriculatum** (Sw.) Presl, var **nervosum** (Fee) Christ. Stipes fasciculate, decumbent, 10 to 15 cm. long, scaly below or throughout; frond about 30 cm. long, 5 cm. broad; pinnæ numerous, subsessile, crenate,

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without awns, falcate, acute, auricled on the upper side, subcoriaceous; sori minute, scattered, indusia almost wanting.

Mount Mariveles, 1,400 m., *Loher*.

India to Formosa (the type).

(3) **P. aculeatum** (Sw.) Roth. Stipes tufted, 15 cm. and upward in height, more or less clothed with ovate-lanceolate and fibrillose pale brown scales; frond 30 to 60 cm. high, 20 cm. broad, bipinnate below or almost throughout; pinnæ close, horizontal, lanceolate; pinnules ovate-rhomboidal, oblique, auricled on the acroscopic side at base, aristate-serrate, subcoriaceous, almost glabrous; rachises fibrillose or scaly; sori principally in rows, nearer the midrib than the margin. An exceedingly variable species, or type of a large group of closely related species, of which our material is not sufficient to determine which are distinct enough to be profitably named. Beside fairly typical specimens the following varieties are reported:

Hastatum Ten., Davao, *Warburg* 14150.

Subamœnum Christ, Davao, *Warburg* 14124, 14136.

Batjanense Christ, which is almost tripinnate, Benguet, *Loher*.

Luzon, *Steere;* Davao, *Warburg* 14149, *Copeland* 1031.

Cosmopolitan.

(4) **P. obtusum** (Mett.) Presl. Stipes tufted, 10 to 15 cm. high, densely clothed with large, ovate-acuminate, bright brown scales; frond 30 cm. or more high, 10 to 15 cm. broad, lanceolate; pinnæ numerous, distant, linear-lanceolate, the lower ones 6 to 10 cm. long; pinnules distinct, oblong-rhomboidal, the obscure teeth blunt or mucronate, subcoriaceous, glabrous; rachis densely fibrillose; sori in rows midway between the midrib and margin.

Luzon, *Cuming* 234, *Lobb;* Mount Arayat, *Loher;* Baguio, *Topping* 179.

Not very distinct from P. aculeatum.

(5) **P. amabile** (Bl.) Presl. Rhizome creeping, scaly; stipes scattered, about 30 cm. high, slender, stramineous, scaly toward the base; frond 30 cm. or more high, 20 to 25 cm. broad, with a lanceolate, acuminate, terminal pinna, and 3 to 6 similar lateral ones on each side; pinnules rhomboidal, with at least half of the lower side cut away, 10 to 15 mm. long, over half as broad, the upper side and outer half of the lower lobed and sharply spinulose-serrate, subcoriaceous, glabrous; sori submarginal, small.

Benguet, *Loher;* Davao, *Copeland* 1114.

India to Formosa and Java.

(6) **P. aristatum** (Sw.) Presl. Rhizome creeping; stipes scattered, 30 to 50 cm. high, clothed at least toward the base with linear or fibrillose scales; frond 30 to 60 cm. high, 20 to 30 cm. broad, ovate-deltoid, tri- or quadripinnatifid; lower pinnæ largest, 15 to 25 cm. long, subdeltoid; lowest pinnules much largest, lanceolate-deltoid, 5 to 10 cm. long, with subdeltoid lower segments; teeth copious, aristate; texture subcoriaceous; glabrous, rachis nearly so; sori small, principally in rows near the midrib; indusium sometimes reniform.

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Luzon, *Steere;* Benguet and Arayat, *Loher;* Camarines, *Baranda.*

Africa to Japan and Polynesia.

(7) **P. conifolium** (Wall.) Presl. Rhizome erect; stipes clustered, 20 to 50 cm. high, clothed at the base with narrow black scales, stramineous; frond 30 to 50 cm. high, deltoid; pinnæ deltoid, the lowest 10 to 15 cm. long, with its lowest basipetal pinnule largest, usually falcate, 6 to 8 cm. long, its pinnules of the second order stalked and toothed or lobed, spinulose, subcoriaceous, glabrous; sori mostly in rows along the midribs.

Luzon, *Cuming* 262; Benguet, *Loher, Topping* 192; Arayat, *Merrill* 3815; Mount Mariveles, *Copeland, Barnes* 136, 142; *Whitford* 136.

Africa to Polynesia.

(8) **P. horizontale** Presl., in Epim. Bot., p. 57. Stipes clothed with short, ovate, and long, linear acuminate scales; frond about 1 m. high, ovate, tripinnate; pinnæ subopposite, short stalked, linear, very acute, the lower ones horizontal; primary pinnules subsessile, oblong-lanceolate, acute; secondary pinnules sessile, rhomboidal, obtuse, mucronate-dentate, coriaceous, the veins beneath bearing scattered, minute scales; sori rather large, with coriaceous, persistent indusium.

Luzon, *Cuming.*

(9) **P. varium** (L.) Presl. Rhizome short, creeping; stipe 30 to 60 cm. high, densely fibrillose toward the base; frond 30 to 50 cm. high, about 30 cm. broad; lower pinnæ the largest, 15 cm. long, subdeltoid, with the lowest basipetal pinnules elongate, 8 cm. long, and divided into distinct, linear-oblong, falcate secondary pinnules; the rest of the frond only bipinnate, teeth rather obscure, not spinulose; coriaceous, glabrous, but rachis and midribs fibrillose; sori medial; indusia reniform or peltate.

Baguio, *Elmer* 6,489; Arayat, *Loher.*

Japan and China.

(10) **P. falcatum** (L.) Diels. Stipes tufted, 15 to 30 cm. high, beset at the base with large, dark scales; frond 30 to 60 cm. high, ovate-lanceolate, simply pinnate; pinnæ numerous, the lower ones stalked, ovate-acuminate, falcate, 10 to 15 cm. long, 2 to 5 cm. broad, entire or slightly undulate, contracted suddenly on the upper side and often auricled; rounded or obliquely truncate on the lower, coriaceous, glabrous, glossy above; veins as a rule anastomosing toward the margin; sori small, copious, scattered.

Mount Data, 2,250 m., *Loher.*

Natal across India to Hawaii.

(4) NEPHRODIUM Richard.

Fertile and sterile fronds or parts of the frond not differentiated, or but slightly so; veins free, or the branches of adjacent veins anastomosing to form regular areolæ, triangular next the costa, trapezoidal farther out; sori round, the indusim cordate-reniform or wanting. Mostly terrestrial ferns, of medium or large size, thin or moderately firm, but not very coriaceous, compound. Related through *Pleocnemia* to *Aspidium.* A very large genus, so natural that even the separation of the two great

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subgenera leaves several species in an equivocal position. In spite of this homogeneity it includes a large number of genera proposed at different times.

Lastræa: Veins free.

1. Simply pinnate, pinnæ not incised beyond the middle..... (1) *N. hirtipes*
1. Simply pinnate, pinnæ incised beyond the middle.
  2. Lowest pinnæ not reduced conspicuously.
    3. Lowest pinnæ considerably longer than others.
      4. Frond over 30 cm. high..... (2) *N. distans*
      4. Frond under 10 cm. high ..... (3) *N. grammitoides*
    3. Lowest pinnæ not longer than others.
      4. Segments of pinnæ at right angle to costa.
        5. Segments obtuse ..... (4) *N. crassifolium*
        5. Segments acute ..... (5) *N. Fauriei elatius*; (6) *N. attenuatum*
      4. Segments of pinnæ forming acute angles.
        5. Veinlets less than 10 on a side.
          6. Lower surface villous..... (7) *N. calcaratum*
          6. Lower surface grandular .... (8) *N. viscosum*
          6. Lower surface glabrous ..... (15) *N. sagenoides*
        5. Veinlets more than 10 on a side.
          6. Sori submarginal, texture thin ..... (9) *N. immersum*
          6. Sori marginal, subcoriaceous (10) *N. ligulatum*
  2. Lowest pinnæ reduced, veinlets simple.
    3. Pinnæ not lobed nearly to their midrib..... (11) *N. exiguum*
    3. Pinnæ lobed nearly or quite to their rachis.
      4. Veinlets 4 or 5 on a side..... (12) *N. Beddomei*
      4. Veinlets 8 to 12 on a side..... (13) *N. Luersseni*; (14) *N. oxydon*
  2. Lowest pinnæ reduced, veinlets forked.
    3. Lobes of pinnæ entire.
      4. Sori subterminal, indusium absent..... (16) *N. obscurum*
      4. Sori subterminal, indusium present ..... (17) *N. syrmaticum*
    3. Lobes of pinnæ toothed or pinnatifid.
      4. Surfaces glabrous, young indusium red.. (18) *N. erythrosorum*
      4. Surfaces glabrous, indusium never red.... (19) *N. Preslii*
      4. Lower surface villous..... (20) *N. flaccidum*
1. Decompound (except *N. dissectum*).
  2. Small or middle sized ferms with erect rhizome.
    3. Frond ovate-lanceolate, glabrous ..... (21) *N. sparsum*
    3. Frond deltoid, pubescent beneath..... (22) *N. crenatum*
  2. Small or middle sized ferns, rhizome creeping.
    3. Sori marginal ..... (23) *N. recedens*
    3. Sori medial ..... (24) *N. hirtum*
  2. Large ferns, indusium usually inconspicuous.
    3. Bipinnatifid ..... (25) *N. dissectum*
    3. Bipinnate.
      4. Lamina glabrous ..... (26) *N. intermedium*
      4. Both surfaces villous ..... (27) *N. asperulum*
    3. Tripinnate.
      4. Indusium present.
        5. Frond not glabrous ..... (28) *N. setigerum*
        5. Glabrous throughout ..... (29) *N. divisum*
      4. Indusium wanting.
        5. Rhizome erect ..... (30) *N. ornatum*
        5. Rhizome creeping ..... (31) *N. rugulosum*
    3. Quadripinnate ..... (32) *N. megaphyllum*

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Goniopteris: Veinlets from neighboring veins anastomosing regularly.

1. Terminal pinna much exceeding the lateral, lobes uniform.
    2. Sori small, lamina not villous ..... (33) *N. simplicifolium*
    2. Sori large, lamina villous.
        3. Frond obtuse ..... (34) *N. Bakeri*
        3. Frond acuminate ..... (35) *N. canescens*
1. Terminal pinna exceeding lateral or not, lobes of pinnæ very unequal ..... (36) *N. diversilobum*
1. Terminal pinna hardly exceeding lateral, lobes uniform.
    2. Rhizome creeping.
        3. Lower pinnæ hardly, if at all, reduced.
            4. Pinnæ entire ..... (37) *N. rubidum*
            4. Segments of pinnæ entire.
                5. Sori marginal in the lobes ..... (38) *N. pteroides*
                5. Sori not confined to lobes, pinnæ not lobed over half way to costa.
                    6. Indusium hairy ..... (39) *N. unitum*
                    6. Indusium absent, sori indefinite ..... (40) *N. aoristisorum*
                    6. Indusium absent, sori definite.
                        7. Proliferous ..... (41) *N. proliferum*
                        7. Not proliferous ..... (42) *N. urophyllum*
                    6. Indusium present, not hairy (43) *N. moulmeinense*
                5. Sori not confined to lobes, pinnæ lobed two-thirds of way to costa.. (44) *N. extensum*
            4. Segments of pinnæ sharp toothed..... (45) *N. Otaria*
        3. Lower pinnæ shorter than the succeeding.
            4. Glabrous ..... (46) *N. aridum*
            4. Not glabrous beneath.
                5. Rachis nearly naked ..... (47) *N. cucullatum*
                5. Rachis villous, sori marginal ..... (48) *N. loherianum*
                5. Rachis villous, sori medial.
                    6. Pinnæ 15 cm. long, villous beneath ..... (49) *N. invisum*
                    6. Pinnæ 25 cm. long, glandular ..... (50) *N. hirsutum*
    2. Rhizome erect.
        3. Pinnæ entire, or not lobed one-third of distance to midrib.
            4. Lowest pinnæ not much reduced.
                5. Pinnæ under 10 cm. long ..... (51) *N. glandulosum*
                5. Pinnæ over 20 cm. long ..... (52) *N. philippinense*
            4. Lowest pinnæ reduced.
                5. Rachis and lower surface glabrous (53) *N. latipinna*
                5. Rachis and lower surface not glabrous.
                    6. Lower pinnæ gradually smaller and deflexed..... (54) *N. amboinense*
                    6. Lower pinnæ very abruptly reduced.
                        7. Veinlets 3 to 4 on a side ..... (55) *N. Arbuscula*
                        7. Veinlets 6 to 9 on a side ..... (56) *N. pennigerum*
        3. Pinnæ incised one-third or two-thirds of distance to midrib.

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4. Lower pinnæ abruptly reduced to auricles ..... (57) *N. hispidulum*
4. Lower pinnæ not abruptly reduced to auricles.
5. Stipe black fibrillose, later rough.. (58) *N. ferox*
5. Stipe naked or villous.
6. Frond about 40 cm. high, sori medial ..... (59) *N. parasiticum*
6. Frond about 1 m. high, sori close to veins ..... (60) *N. truncatum*

(1) **N. hirtipes** (Bl.) Hooker. Stipes tufted, 30 cm. or more high, densely clothed with long, blackish, fibrillose scales; frond 60 to 100 cm. high, 20 to 40 cm. broad; pinnæ 10 to 20 cm. long, 2 to 3 cm. broad, cleft about one-third of the way to the midrib into obtuse lobes, herbaceous, glabrous, the lower ones not reduced; rachis fibrillose like the stipe; veinlets 4 or 5 on each side; sori medial, indusium sometimes wanting.

Benguet and Arayat, *Loher*.

India and Malaya.

(2) **N. distans** (Don) Diels. Rhizome more or less creeping; stipes 30 to 45 cm. high, slender, glossy, stramineous or chestnut; frond 40 to 100 cm. high, 20 to 30 cm. or more broad; lowest pinnæ rather the largest, 15 to 20 cm. long, 4 cm. broad, cut down nearly or quite to the rachis into deeply pinnatifid pinnules 6 mm. broad, with obtuse or acute, toothed or subentire lobes, herbaceous, slightly pubescent beneath; rachis naked; veinlets slightly pinnate in the lower lobes, pellucid; sori scattered, copious, exindusiate.

Benguet, *Loher*.

India to Celebes.

(3) **N. grammitoides** (Christ, Bull. Herb. Boiss. 6:193). Rhizome short creeping, scaly; stipes weak, 3 to 4 cm. high, stramineous, clothed, like the entire plant, with short, stiff, whitish hairs; frond 5 to 7 cm. long, 15 to 20 mm. broad, caudate-attenuate, broadest at the base, bipinnatifid; free pinnæ about 6 pairs, remote, alternate, sessile, triangular-deltoid, acuminate, incised below to the costa into acute, triangular, crenate lobes 4 mm. long; veins pinnate in the lobes; sori minute, round, 3 or 4 on each side of the vein; indusium minute and pilose, or wanting.

Mount Mariveles, 1,400 m., *Loher*.

(4) **N. crassifolium** Hooker. Stipes tufted, 30 cm. or more high, glossy, slightly villous; frond 40 to 60 cm. high, 20 to 30 cm. broad; pinnæ 10 to 15 cm. long, 2 to 4 cm. broad, their lobes obtuse, falcate, 4 to 6 mm. broad, reaching from half to two-thirds down to the midrib, subcoriaceous, glossy but the midribs finely villous, lower pinnæ distinctly stalked; veinlets 10 to 12 on each side, with the sori nearer the midrib than the margin; indusium small, evanescent.

Philippines, *Loher*; Negros, *Copeland* 93.

Malaya.

(5) **N. Fauriei** (Christ) var. **elatius** (Christ). Probably belongs here. It is a small fern, with very narrow fronds, and consequently short pinnæ,

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and large sori; in the Philippine form the pinnæ are incised at the base to the rachis, or nearly so.

Mount Tonglon, 2,250 m., *Loher.*

Japan.

(6) **N. attenuatum** (J. Sm.) Baker. Stipes 30 cm. or more high, firm, glossy, naked; frond about 100 cm. high, 60 cm. broad; pinnæ 20 to 30 cm. long, 2 to 3 cm. broad, long-acuminate, incised three-fourths of the way to the costa into spreading, entire, obtuse lobes 2 mm. broad, the basal lobes much reduced, subcoriaceous, glandular beneath, lowest pinnæ slightly stalked; veinlets 12 to 16 on each side; sori in a close row, indusiate.

Samar, *Cuming* 327; Rizal, *Loher.*

(7) **N. calcaratum** (Bl.) Hooker. Rhizome short, erect; stipes densely tufted, stramineous, 20 cm. high; frond 30 to 40 cm. high, 10 to 15 cm. broad; pinnæ spreading, 4 to 10 cm. long, 1 to 2 cm. broad, cut down two-thirds or more of the way to the midrid into oblique, subfalcate, linear-oblong, acute or obtuse lobes, the lowest acroscopic the longest, herbaceous or subcoriaceous, dark green, more or less villous beneath; veinlets 3 to 6 on each side; sori medial, indusium glabrous, persistent.

Philippines.

India and Malaya.

(8) **N. viscosum** Baker. Stipe 15 cm. or more high, firm, erect, reddish brown, slightly scaly, finely villous; frond 20 to 30 cm. high, about 10 cm. broad, oblong-lanceolate; pinnæ close, 5 to 8 cm. long, 1 cm. broad, cut down nearly to the midrib into close, spreading, linear-oblong lobes, herbaceous, dark green, densely glandular beneath; veinlets 5 to 6 on a side; sori medial, indusiate.

Philippines, *Lobb.*

Malacca and Borneo.

(9) **N. immersum** Hooker. Stipes tufted, 60 cm. or more high, stramineous, scaly at base, naked above, or sparsely pubescent at top; frond 100 to 200 cm. high, 40 to 60 cm. broad; pinnæ 20 to 30 cm. long, 20 to 35 mm. broad, almost horizontal, acuminate, cut down almost to the midrib into close, spreading, subacute, linear lobes 2.5 mm. broad, papyraceo-herbaceous, pubescent with stiff white hairs nearly 1 mm. long; veinlets 10 to 15 on each side; sori nearer the margin than the vein, immersed so as to be prominent on the upper side; indusium peltate.

Southern Luzon, *Baranda;* Davao, *Copeland* 695. Our plant is atypical in the close lobes and more pubescent fronds.

Assam to New Caledonia.

(10) **N. ligulatum** Hooker. Stipes gray, glossy, naked; frond about 100 cm. high, 30 to 50 cm. broad; pinnæ 15 to 25 cm. long, 2 to 3 cm. broad, cut down very nearly to the midrib into linear, obtuse, entire, erecto-patent libes 2 mm. broad with more than their own space between them, subcoriaceous, finely pubescent beneath, as is the rachis; veinlets 10 to 12 on a side; sori quite marginal, indusiate.

Luzon, *Cuming* 94; Cagayan-Luzon, *Warburg* 12216; Cebu, *Cuming* 343.

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(11) **N. exiguum** Hooker. Stipes tufted, 15 to 25 cm. high, slender, gray, naked; frond 20 to 25 cm. high, 3 to 5 cm. broad; pinnæ 2 to 3 cm. long, 1 cm. broad, cut down half way to the midrib or more into close, obtuse lobes, papyraceo-herbaceous; rachis villous; veinlets obscure, 2 to 3 on each side; sori near the veins.

Luzon, *Cuming* 251, 272.

(12) **N. Beddomei** Baker. Rhizome slender wide-creeping; stipe 15 to 25 cm. high, slender, glossy; frond 15 to 50 cm. high, 5 to 10 cm. broad, lanceolate; central pinnæ the largest, 3 to 5 cm. long, lanceolate, cut down to their rachis into close, rather acute, entire lobes, glabrous except for the veins, firm; lower pinnæ distant and dwindling down very gradually; veinlets 4 to 5 on a side; sori close to the incurved margin, indusiate.

Benguet, *Loher*, *Topping* 331, *Elmer* 6491.

India, Java, southern China.

(13) **N. Luerssenii** Harrington, Journ. Linn. Soc. 16:29. Stipes clustered, firm, shining, light purplish; frond 45 to 75 cm. high, 15 to 25 cm. broad, oblong, tapering abruptly to the base; pinnæ 10 to 20 cm. long, 2 to 4 cm. broad, lanceolate, acuminate, jointed at the base, cut down almost or quite to the rachis into numerous linear or oblanceolate lobes 2 to 4 cm. long, membranaceous, glabrous, lowest pinnæ very small; veinlets 8 to 12 on a side, distant; sori marginal, indusiate. Near N. prolixum Baker.

Baluku Island, growing on the margin of a pond, *Steere*.

(14) **N. oxydon** (Baker in Journ. of Bot., 1879, p. 66, sub Polypodio) should probably be inserted here.

Jolo Archipelago, *Burbidge*.

(15) **N. sagenoides** (Mett.) Baker. Stipes tufted, slender, 15 to 50 cm. high, almost black, polished, scaly at the base; frond 30 to 60 cm. high, half as broad; pinnæ 10 to 15 cm. long, 3 to 4 cm. broad, narrowed gradually from the base to the apex, cut down nearly to the midrib into linear-oblong, obtuse, crenate or entire lobes, papyraceo-herbaceous, glabrous; veinlets 6 to 10 on a side, forked; sori terminal on the acropetal branch, nearer the margin than the vein, indusiate.

Davao, *Warburg* 14122, *Copeland* 1238.

Malaya.

(16) **N. obscurum** (Fee) Diels. Stipes tufted, 30 cm. high, black, glossy, naked; frond 20 to 40 cm. high, deltoid-oblong, acuminate; pinnæ about 10 cm. long, 2 to 3 cm. broad, cut three-fourths of the way to the midrib into close, obtuse lobes 5 mm. broad, thin-papyraceous; veinlets 6 to 8 on a side, forked; sori subterminal on the acropetal branches, medial.

Philippines, *Cuming* 302; Rizal, *Loher*, a small form.

Tavoy?

(17) **N. syrmaticum** (Willd.) Baker. Rhizome erect; stipes tufted, 30 to 60 cm. high, stramineous; frond 100 cm., more or less, high, less than half as broad; pinnæ 15 to 25 cm. long, about 4 cm. broad, cut down

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almost to the midrib into slightly toothed lobes 5 mm. broad, subcoriaceous, glabrous, the lowest stalked, not much reduced; veinlets 8 to 12, sometimes more than once forked; sori subterminal on the branches, as near the margin as the midrib, indusium small but evident. Near N. crassifolium.

Luzon, *Cuming* 13, 14, 154; Sorsogon and Catanduanes, *Baranda;* Bohol, *Cuming* 354; Davao, *Copeland* 669, 928, 953, small forms; Zamboanga, *Copeland* 736.

India, Malacca.

(18) **N. erythrosorum** Hooker. Stipes tufted, 15 to 25 cm. high, more or less densely clothed with long lanceolate and linear scales; frond 30 to 50 cm. high, 20 to 30 cm. broad, ovate-lanceolate; pinnæ lanceolate, the lowest the largest, 10 to 15 cm. long, cut quite down to the rachis below into oblong-obtuse pinnules which are slightly, sometimes spinosely, toothed, herbaceous but firm, glabrous; sori in rows of 6 to 9, near the veins; indusium 1 mm. broad, flat, bright red when young.

Japan and China.

Benguet, *Loher.*

(19) **N. Preslii** Baker. Stipes 15 to 25 cm. high, slender, deciduously fibrillose; frond 15 to 25 cm. high, 10 to 15 cm. broad, lanceolate-deltoid; upper pinnæ lanceolate, close; lowest pair deltoid, the upper pinnules 4 mm. broad, obtuse, entire, the lower ones pinnatifid with similar lobes and broad uncut center, subcoriaceous, glabrous; rachis fibrillose; sori about 6 to the lower lobes, dorsal on the veins, nearer the vein than the margin.

Luzon, *Cuming* 255.

(20) **N. flaccidum** Hooker. Stipes tufted, 30 cm. or more high, slender, stramineous, naked; frond 30 to 50 cm. long, 15 to 20 cm. broad; pinnæ 7 to 10 cm. long, 2 to 3 cm. broad, cut down to a rachis with a narrow, distinct wing into oblong lobes 4 mm. broad, cut about half way down in turn, herbaceous, villous beneath, like the rachis; lower pinnæ distant, shorter than the others and deflexed; veinlets forked, or in the lower lobes subpinnate; sori about midway between the vein and margin.

Benguet, *Loher.*

Himalayas to Java.

(21) **N. sparsum** Don. Stipes tufted, 15 to 30 cm. high, scaly near the base, stramineous and glossy above; frond 30 to 60 cm. high, 20 to 30 cm. broad, ovate-lanceolate; lowest pinnæ the largest, 10 to 15 cm. long, 3 to 5 cm. broad; lowest pinnule sometimes compound, the others lanceolate, unequal sided, pinnatifid with oblong, obtuse lobes, herbaceous but firm, glabrous, pale green; sori usually one to each lobe, near the vein; indusium flat, naked, 2 mm. broad.

Benguet, *Loher, Topping* 282.

Mauritius to Malaya and China.

(22) **N. crenatum** (Forsk.) Baker. Stipes 25 to 50 cm. high, stramineous, glossy, densely clothed at the base with a tuft of lanceolate, bright brown scales; frond 20 to 40 cm. high, deltoid; lowest pinnæ much the largest, deltoid, 15 to 25 cm. long, 6 to 10 cm. broad; pinnules lanceolate,

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often imbricate, with ovate or oblong pinnatifid segments with rounded lobes, herbaceous, pale green, pubescent beneath as is the rachis; sori copious; indusium large, pale, villous.

Cagayan-Luzon, *Warburg* 12205; Benguet, *Loher*, *Elmer* 6480, 6595; Arayat, *Loher*.

Cape Verde Islands to China.

(23) **N. recedens** (J. Sm.) Hooker. Rhizome wide-creeping; stipe about 30 cm. high, erect, villous, soft, clothed at the base with squarrose, linear scales; frond 40 to 60 cm. high, 30 cm. or more broad, deltoid; lower pinnæ much the largest, 15 to 30 cm. long, 10 to 15 cm. broad; pinnules of the lower side the largest, sometimes 15 cm. long, 5 cm. broad, with distinct, one-sided lanceolate segments with close, slightly toothed linear-oblong lobes, firm, nearly glabrous; rachises villous; sori small, 6 to 8 around the margin of the larger lobes.

Luzon, *Cuming* 96.

Ceylon and southern India.

(24) **N. hirtum** (Presl.), non Hooker. Frond deltoid, decompound, 30 cm. long; rachises clothed with copious appressed, linear, brown paleæ; lower pinnæ the largest, deltoid, the lower side the more developed; central pinnæ oblong-lanceolate; final segments oblong, entire, 2 mm. broad, moderately firm, glabrous; veinlets few, erecto-patent; sori medial.

"Philippines," *Haenke*.

(25) **N. dissectum** (Forst.) Desv. Stipes tufted, 30 cm. or more high, rather slender, glossy, clothed toward the base with linear, dark brown scales; frond 30 to 150 cm. high, 30 to 100 cm. broad, deltoid; lower pinnæ varying from simply pinnatifid, with broad obtuse lobes, to 30 cm. long, with similar pinnatifid pinnules, the center usually uncut for a breadth of 1 cm., and the uncut obtuse or acute ultimate divisions equally broad, papyraceo-herbaceous, bright green, nearly glabrous; sori copious, generally submarginal; indusium flat, 1 mm. or more broad.

Luzon, *Cuming* 36, 249.

Madagascar to Polynesia.

(26) **N. intermedium** (Bl.) Baker. Stipe 30 to 60 cm. high, stout, erect, densely clothed at the base with long, bright brown, silky fibrils; frond 60 to 100 cm. high, 30 to 50 cm. broad, subdeltoid; lower pinnæ lanceolate, often 30 cm. long, 10 cm. broad; pinnules close, lanceolate, with distinct oblong-lanceolate segments with ligulate, subentire lobes about 2 mm. broad, herbaceous, firm, glabrous or slightly scaly on the midribs; sori small, copious, nearer the veins than the margin; indusium thin, fugacious.

Benguet and Rizal, *Loher*.

Ceylon to Japan.

(27) **N. asperulum** (J. Sm.). Stipe firm, terete, brownish, pubescent; frond 40 to 60 cm. high, 30 cm. or more broad; lower pinnæ 15 to 25 cm. long, 5 to 8 cm. broad; pinnules lanceolate, 1 cm. broad, oblique, cut down to the rachis below into oblique, oblong, pinnatifid segments, sub-

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coriaceous, villous on both surfaces; veinlets immersed; sori copious, one to each ultimate segment.

Luzon, *Cuming* 63; Albay, *Baranda.*

(28) **N. setigerum** (Bl.) Baker. Rhizome creeping; stipe 30 to 50 cm. high, scaly at the base, naked in the middle, villous at the top, stramineous; frond 40 to 100 cm. high; lowest pinnæ the largest, 20 to 30 cm. long, half as broad; pinnules close, linear-lanceolate, reaching a length of 10 cm. their segments pinnatifid more than half way to the midrib, herbaceous, glabrous or sparingly hirsute; sori minute, numerous; indusium fugacious.

Cagayan-Luzon, *Warburg* 12207; Benguet, *Topping* 178; Rizal, *Guerrero* 1.

India across Polynesia.

(29) **N. divisum** Hooker. Stipes 60 to 100 cm. high, brownish, glabrescent; fronds 2 to 3 m. high, spreading; lower pinnæ 30 to 50 cm. long, 20 to 25 cm. broad; pinnules lanceolate, acuminate, their rachis very slightly winged, their rather obtuse segments cut down over half way to the midrib into sharp teeth or toothed lobes, papyraceous, glabrous, deep green; sori nearer the midrib than the margin, usually one to each tooth or lobe, indusiate.

Mount Apo, *Copeland* 1138.

India, Bourbon, Java.

(30) **N. ornatum** (Wall.) Baker. Rhizome erect; stipe densely chaffy at the base and more or less so throughout, 50 to 100 cm. high; fronds 1 m. high and upward, ovate, at least tripinnate, exceedingly variable, villous beneath, herbaceous; sori often sheltered by the incurved margin, exindusiate. This is rather doubtfully distinct from *N. setigerum.*

Luzon, *Cuming* 1, 75, 412; Rizal, *Loher;* Davao, *DeVore* and *Hoover* 360, 361, *Copeland* 611.

India to Celebes.

(31) **N. rugulosum** (Labill.). Rhizome wide-creeping, rather hairy than scaly; stipe 30 to 50 cm. high, puberulous and glandular; frond 30 to 120 cm. high, deltoid; lower pinnæ the largest, themselves less broadly deltoid, their pinnules with distinct, obtuse, more or less deeply crenate segments 1 cm. long, 3 mm. broad, firm-papyraceous, viscid-puberulous, very sparsely so above, pale green, especially beneath; sori copious, or one at the base of each tooth, on the upper side, exindusiate. This is probably a form of *N. punctatum* Diels; but that name is invalidated under the Berlin rules by *Acrostichum punctatum* L., and under the Kew rules by *Nephrodium punctatum* Parish. Strikingly like *Hypolepis.*

Baguio, *Topping* 252.

All warm countries except Africa.

(32) **N. megaphyllum** Baker. An enormeous fern, several meters high; stipe 15 mm. or more thick, rough, clothed with appressed, subulate scales, as is the rachis; frond ample, quadripinnate; pinnæ 75 cm. long, 15 cm. broad, stalked, acuminate; pinnules almost sessile, remote, alternate, ovate-oblong; pinnules of the third order 3 cm. long, almost sessile, broadly

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triangular-ovate, their rachis narrowly winged; segments of the fourth order ovate, incised into coarse truncate-obtuse teeth, furfuraceous; sori single at the base of the ultimate lobes; indusium reniform.

Baguio, *Loher*.

Borneo.

(33) **N. simplicifolium** Hook. Rhizome creeping; stipes tufted, strong, villous upward, about 10 cm. high; frond 15 to 30 cm. high, with a lanceolate-acuminate, entire apex about 3 cm. broad, and at its base 1 to 6 small blunt, spreading, entire, distinct pinnæ, subcoriaceous; midrib hispid beneath, and the prominent veins slightly so, main veins 3 mm. apart, all the veinlets anastomosing; sori minute, indusium wanting.

Leyte, *Cuming* 315.

Fiji.

(34) **N. Bakeri** Harrington. Rhizome erect (?); stipes clustered, light brown, villous or scaly, 4 to 10 cm. high; frond oblong-oblanceolate, 10 to 15 cm. high, 2 to 3 cm. broad, obtuse, coarsely crenate or lobed one-third the distance to the costa, with usually 2 to 4 distinct oblong-obovate sessile pinnæ at the base hardly as large as the lobes, papyraceous, villous; veinlets 6 to 8 pairs, the majority of them anastomosing; sori small, midway on the veinlets, the indusium hairy, often absent.

Panay, terrestrial in the mountains, *Steere*.

(35) **N. canescens** (Bl.) Christ. Rhizome creeping; stipe of sterile frond about 5 cm., of fertile about 20 cm. high, erect, villous above; rachis likewise villous; sterile frond 10 cm. more or less, high, ovate-lanceolate, acute, the terminal segment sometimes almost the whole length, sometimes much less than half, crenate; pinnæ truncate at both ends, crenate or slightly lobed toward the broad apex, papyraceous, mostly glabrous; fertile frond similar except that the pinnæ are usually narrower and occupy a relatively large part of the frond; sori near the main veins, or irregularly scattered, indusium usually absent. I follow Christ in referring this plant to Blume's *Gymnogramme canescens*, though our plants are largely glabrous. It is variable here as in Celebes (cf. Christ, Ann. Jard. Buitenz. 15:130).

Isabela-Luzon, *Warburg* 11608, 11611; Nueva Vizcaya, Merrill 162; Rizal, *Loher*; Lamao, *Merrill* 3130, *Copeland* 250; Samar, *Cuming* 322; Davao, *Copeland* 503.

Java, Celebes.

(36) **N. diversilobum** Presl. Rhizome creeping or ascendent; stipe of sterile frond 10 cm., of fertile 20 cm. high; rachis very closely villous; frond 15 to 30 cm. high, lanceolate or ovate; pinnæ opposite, acuminate, below their apex deeply and variously lobed, crenate near the truncate, sometimes auricled base, papyraceous, glabrous except for the costa; fertile frond the same, sori midway on the veinlets, exindusiate.

Luzon, *Cuming* 51, 102; Negros and Davao, *Copeland* 83, 698.

This and the preceding two species are very close together, and probably all very near *N. parasiticum*.

(37) **N. rubidum** Hooker. Stipes firm, erect, glossy, reddish brown, naked; frond 30 to 50 cm. high, 30 cm. or more broad; pinnæ numerous,

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the lowest stalked, 15 to 20 cm. long, 2 cm. broad, acuminate, entire or nearly so, subcoriaceous, glabrous; veinlets obscure, 8 to 10 on a side; sori close to the main veins, exindusiate.

Luzon, *Cuming*; Camarines and Sorsogon, *Baranda*.

Java and Borneo (?).

(38) **N. pteroides** (Retz.) J. Sm. Rhizome hypogæous, creeping; stipe 30 to 60 cm. high, slender, almost naked; frond 40 to 80 cm. high, 30 to 40 cm. broad; pinnæ spreading, 15 to 25 cm. long, 1 to 2 cm. broad, serrate with triangular teeth seldom one-third the depth to the midrib, papyraceo-herbaceous, rachis and veins somewhat hairy beneath; veinlets 5 to 8 on each side; sori confined to the margin of the teeth, indusiate.

Rizal, *Loher;* Sorsogon, *Baranda;* Mindoro, *Merrill* 984; Culion, *Merrill* 484, 594; Mindanao, *Cuming* 293; Davao, *Copeland* 636.

India and China to Queensland and Polynesia.

(39) **N. unitum** R. Br. Stipes 30 to 50 cm. high, brownish, naked; frond 60 cm. or more high, 15 to 20 cm. broad; pinnæ 10 to 15 cm. long, 1 to 2 cm. broad, cut from a third to half way down into spreading, triangular, acute lobes, coriaceous, the lower ones not dwindling down; veinlets 6 to 8 on each side; sori nearly terminal, principally in the lobes, indusium hairy.

Luzon, *Cuming* 259.

Pantropic.

(40) **N. aoristisorum** (Harrington, in Journ. Linn. Soc. **16**:30). Rhizome short and thick, with slender, brown scales; stipes clustered, 8 to 15 cm. high, slender, gray slightly pubescent above; frond 15 to 25 cm. high, 2 to 4 cm. broad, linear-lanceolate, the lower pinnæ reflexed; pinnæ 20 to 40 pairs, 12 to 16 mm. long, half as broad, elliptical, slightly falcate, obtuse, coarsely crenate, auricled on the upper side, sessile or nearly so, subcoriaceous, pubescent beneath, as is the rachis; veinlets 2 or 3 on each side, of which but one usually anastomoses with the opposite one of the next lobe; sori not definitely bounded, the sporangia more or less scattered.

Panay, terrestrial in mountains, *Steere*.

(41) **N. proliferum** (Presl.). Rhizome stout, creeping; stipes spreading, naked, 5 to 20 cm. high; frond 30 to 60 cm. long, 15 to 30 cm. broad, erect or decumbent, often elongate and rooting at the point and branched copiously from the axils; pinnæ 10 to 15 cm. long, 1 to 2 cm. broad, broadest at the truncate or cordate base, obtuse, bluntly lobed about 2 mm. deep, subcoriaceous, naked or nearly so; veinlets 6 to 10 on a side; sori medial, oval, sometimes confluent, exindusiate.

Luzon, *Cuming* 168; Benguet, *Loher*.

Africa to Polynesia.

(42) **N. urophyllum** (Wall.) Beddome. Rhizome horizontal, short and stout; stipe 50 to 80 cm. high, erect, nearly naked; frond 60 cm. or more high, 30 to 50 cm. broad; pinnæ rather few, 20 to 30 cm. long, about 5 cm. broad, acuminate, entire or crenate, sessile, papyraceous,

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glabrous; veinlets about 15 pairs, the sori medial on them, forming two rows, or, near the midrib, terminal and forming a single row, exindusiate.

Luzon, *Baranda, Steere*; Davao, *Warburg* 14171, *Copeland* 952.

India to Queensland and Polynesia.

(43) **N. moulmeinense** Beddome. Rhizome short, creeping; stipe 60 to 120 cm. high, erect, naked unless at the top; frond 60 to 120 cm. high, 40 to 60 cm. broad; pinnæ usually more than 6 on each side, 20 to 30 cm. long, scarcely 4 cm. broad, long-acuminate, entire or crenate or more often serrate with falcate teeth 2 to 3 mm. deep, abruptly contracted to the sessile or subsessile base, subcoriaceous, glabrous or nearly so, smooth; veinlets about 15 on a side; sori medial on them, mostly with a visible indusium.

Rizal, *Loher;* Mindoro, *Merrill* 997; Zamboanga, *Copeland;* Davao, *Copeland* 1240, called "Saiop" in Bagobo.

India and Malaya.

This species differs typically from the preceding in being of firmer texture, with more numerous, narrower, and more uniformly narrow pinnæ with less entire margin, more numerous main veins, and indusia; in practice, they are not very distinct.

(44) **N. extensum** (Bl.) Hooker. Stipe 30 to 60 cm. high, naked or nearly so, brownish; frond 60 to 120 cm. high, 30 to 50 cm. broad; pinnæ 15 to 25 cm. long, about 2 cm. broad, cut down about two-thirds of the way to the rachis into linear-oblong lobes, papyraceo-herbaceous, naked or nearly so; veinlets 6 to 8 on each side, often only the lowest pair united; sori nearly terminal, not confined to the lobes, indusiate.

Rizal, *Loher;* Albay, *Baranda.*

India, Malacca.

(45) **N. Otaria** Baker (*Anisocampium Cumingianum* Presl.). Stipe 15 to 30 cm. high, substramineous; frond 30 cm. or more high, with a linear-oblong terminal pinna 10 to 15 cm. long, 2 to 4 cm. broad, acuminate, lobed one-fourth to one-third of the way to the midrib into finely serrate lanceolate lobes, and 3 to 6 distant, spreading, similar lateral pinnæ on each side, the lower ones stalked, thinly herbaceous, glabrous; veinlets 6 to 8 on each side, the lowest uniting midway between the midrib and the edge; indusia present.

Luzon, *Cuming* 239.

India.

(46) **N. aridum** (Don) Baker. Stipe 30 cm. or more high, erect, naked; frond about 100 cm. high, 30 to 50 cm. broad; pinnæ 15 to 25 cm. long, about 3 cm. broad, cut about one-third of the way down to the midrib into subtriangular, acute lobes, coriaceous, glabrous or slightly hairy; veinlets 8 to 10 on a side; sori in rows about midway between midrib and margin.

Luzon, *Cuming* 278.

India, Malaya.

(47) **N. cucullatum** (Blume) Baker. Rhizome wide-creeping; stipe 30 cm. or more high, erect, brownish, nearly naked; frond 40 to 80 cm. high, 20 to 30 cm. broad; pinnæ close, 10 to 15 cm. long, 1 to 2 cm.

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broad, cut down one-third of the way to the midrib into triangular, acute, subfalcate lobes, the lower ones dwindling down suddenly to mere auricles, coriaceous, lower surface, like the rachis, densely pubescent; 8 to 10 veinlets on each side; sori subterminal, indusiate.

Luzon, *Cuming* 254; Cagayan-Luzon, *Warburg* 12206, 12212; Lepanto and Rizal, *Loher;* Nueva Ecija, *Merrill* 283, 284; Benguet, *Elmer* 6486; Mindoro, *Merrill* 879; Davao, *Warburg* 14097, *Copeland* 326, 447.

India across Polynesia.

(48) **N. loherianum** (Christ, Bull. Herb. Boiss. 6:191). Rhizome creeping; stipes subtufted, 30 cm. high, sparsely scaly at the base, densely but closely strigose-pubescent above, as are the rachis and veins; frond deltoid-ovate (aside from some auricles representing the lowest pinnæ), 30 cm. high, 18 to 20 cm. broad, acuminate; pinnæ 10 cm. long, 2 cm. broad, horizontal, lanceolate, acuminate, sessile, cleft down to 3 mm. from the midrib into obtuse, oblong, falcate lobes 3 mm. broad, subcoriaceous, short-pilose, ash-brown; veinlets about 12 pairs, only the lowest anastomosing, and these not always; sori small, marginal, crowded, with pilose indusia.

Montalban, Rizal, *Loher.*

(49) **N. invisum** Carruth. Rhizome stout, wide-creeping; stipe 30 cm. or more high, stout, brownish, villous; frond 45 to 60 cm. high, 20 to 30 cm. broad; pinnæ numerous, 10 to 15 cm. long, 1 cm. or more broad, cut about one-third of the way to the midrib into sharp, triangular, falcate lobes, subcoriaceous, the lower ones distant and dwarfed; rachis and lower surface villous; veinlets 6 to 8 on each side; sori in rows close to the midrib, indusiate; capsules setose.

Mount Mariveles, *Warburg* 12759; Tayabas, *Warburg* 12509.

Polynesia.

(50) **N. hirsutum** J. Sm., Presl. Stipes 100 cm. more or less high, scaly at the base, closely hirsute toward the top; frond 100 to 200 cm. high, 50 cm. or more broad; pinnæ 20 to 35 cm. long, narrowly linear, acuminate, incised about half way to the midrib into obtuse, falcate lobes, subcoriaceous, closely glandular beneath; rachis densely but closely hirsute, surfaces very sparsely hairy; veinlets about 8 on each side; sori medial on them.

Luzon, *Cuming* 82; San Ramon, *Copeland* 751, a form with about 13 veinlets on each side, the sori reaching most of their length.

Celebes.

(51) **N. glandulosum** J. Sm. Stipes tufted, 30 cm. or more long, naked or slightly villous; frond 30 cm. or more high, 10 to 15 cm. broad; pinnæ 8 to 10 pairs, spreading, larger and closer on the sterile frond, 6 to 10 cm. long, 2 to 3 cm. broad, entire or nearly so, truncate and sometimes auricled at the base, papyraceo-herbaceous; rachis and lower surface naked or slightly villous, sometimes glandular; fertile pinnæ somewhat contracted; veinlets 4 to 8 on a side, with the sori close to the midrib, indusiate. Near *N. urophyllum.*

Luzon, *Cuming* 16; Leyte, *Cuming* 298.

Malaya.

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(52) **N. philippinense** Baker, in Ann. Bot. 5:327. Frond oblong-lanceolate, bipinnatifid, 60 to 90 cm. high, 30 to 45 cm. broad, glabrous throughout; pinnæ lanceolate-acuminate about 20 cm. long by 3 cm. broad, cut down less than half way to the rachis into oblong, erecto-patent lobes, moderately firm, the lower ones not dwarfed; veinlets 8 to 9 pairs; sori medial, with firm, glabrous, persistent indusia. Near *N. Arbuscula.*

Luzon, *Cuming* 10, 84; Benguet and Rizal, *Loher;* Cebu, *Cuming* 338.

(53) **N. latipinna** Hooker. Stipes tufted, 10 to 15 cm. high, slender, naked; frond 20 to 30 cm. high, 8 to 12 cm. broad, the upper third or half lanceolate, pinnatifid with broad oblong lobes; below this several pinnæ on each side, the largest 5 to 8 cm. long, about 2 cm. broad, cut about one-fourth of the way down into broad, oblong, subfalcate lobes, papyraceo-herbaceous, the lower ones much reduced and distant; rachis and sides glabrous; 3 to 5 distant veinlets on each side, with a sorus about the middle of each. Doubtfully distinct from *N. parasiticum.*

Isabela-Luzon, *Warburg* 11599, 11604, 11610, 11979; Manila, *Warburg* 12747.

Hongkong, Java.

(54) **N. amboinense** Presl. Stipes tufted, 15 to 20 cm. high, grayish, nearly naked; fronds 60 cm. or more high, 20 to 30 cm. broad; pinnæ spreading, about 10 cm. long, 1 to 2 cm. broad, cut one-fourth of the way to the midrib into obtuse, slightly falcate lobes, papyraceo-herbaceous, the lower shorter and deflexed; rachis and lower surface slightly pubescent; veinlets 4 to 6 on a side; sori in rows close to the midrib.

Luzon, *Cuming* 83; Leyte, *Cuming* 317.

India and Malaya.

(55) **N. Arbuscula** Desv. Stipes tufted, 10 to 20 cm. high, naked or slightly pubescent; frond 30 to 50 cm. high, 15 to 20 cm. broad; pinnæ close, numerous, about 10 cm. long by 1 cm. broad, cut not more than one-fourth of the way to the midrib into obtuse lobes, herbaceous, several of the lower pairs short and distant; rachis and lower side finely villous; veinlets distant, 3 or 4 on a side; sori in close rows.

"Philippines."

India to Polynesia.

(56) **N. pennigerum** (Bl.) Hooker. Stipes tufted, stout, 20 to 30 cm. high, finely villous; frond 60 to 120 cm. high, 30 to 50 cm. broad; pinnæ numerous, spreading, 15 to 25 cm. long, about 3 cm. broad, acuminate, cut about one-fourth of the way to the midrib into oblong, falcate lobes, herbaceous or subcoriaceous, the lower ones dwarfed and distant; rachis and under surface finely villous; veinlets 6 to 9 on a side, the sori medial on them, indusiate; capsules setose. Near *N. moulmeinense.*

Baguio, *Loher.*

Africa, India, Malaya.

(57) **N. hispidulum** Baker. Stipes tufted, slender, 30 to 50 cm. high, grayish, villous; frond 30 to 50 cm. high, 15 cm. broad; pinnæ distant, spreading, about 10 cm. long, 1 cm. broad, acuminate, cut about half

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way to the midrib into oblong, slightly falcate lobes, the lower pinnæ suddenly dwarfed to mere auricles; rachis and under surface finely villous; veinlets 3 to 4 on each side, with a large sorus on each near the margin, indusiate; capsules naked.

Luzon, *Cuming* 268; "Philippines," *Baranda.*

Malaya.

(58) **N. ferox** Moore. Stipe 30 to 80 cm. high, strong, densely fibrillose with black hairs which leave the stipe rough when they fall; frond 90 to 150 cm. high, 60 cm. broad; pinnæ rather close, spreading, 15 to 40 cm. long, 2 to 3 cm. broad, very acuminate, cut about one-third of the way to the midrib into lanceolate-falcate lobes, subcoriaceous, glabrous and glossy; veinlets 10 to 12 on each side; sori close to the main veins.

Benguet, *Loher, Topping,* 162, 320, *Elmer* 6232; Albay, *Baranda.*

Malaya.

(59) **N. parasiticum** (L.) Baker. Rhizome short; stipes tufted, 30 cm. high, slender, deciduously hairy; frond 30 to 60 cm. high, 30 cm. broad; pinnæ spreading, 10 to 15 cm. long, 2 cm. broad, obtuse or acuminate, cut about half way to the midrib into subfalcate obtuse lobes, truncate at the base, herbaceous, finely villous, the lower ones deflexed, usually distant and rather shorter; veinlets 6 to 8 on each side; sori medial, indusiate.

Isabela-Luzon, *Warburg* 11976; Benguet, *Topping* 319; Rizal, *Loher;* Mount Mariveles, *Copeland* 226, 1389; Albay and Masbate, *Baranda;* Culion, *Merrill* 589; Davao, *Warburg* 14096.

All warm countries.

(60) **N. truncatum** Presl. Stipes tufted, stout, erect, 60 cm. high, grayish, naked or slightly villous; frond 60 to 120 cm. high, 30 to 50 cm. broad; pinnæ 15 to 25 cm. long, 2 to 3 cm. broad, very obtuse, cut down one-third of the distance to the midrib, more deeply toward the apex, into obtuse, spreading, oblong lobes, papyraceo-herbaceous, glabrous or nearly so; rachis slightly villous; veinlets 6 to 8 on each side, with a sorus near the base of each. This includes *N. caudiculatum* Sieb. and *N. abruptum* J. Sm.

Luzon, *Cuming* 120, *Steere, Baranda;* Leyte, *Cuming* 317.

India across Polynesia.

(5) MENISCIUM Schreber.

Fronds simple or once pinnate; veins anastomosing as in Goniopteris, the veinlets from adjacent veins uniting in pairs, and from the points of fusion veinlets running toward the margin parallel to the main veins; sori elongate along the cross-veinlets, exindusiate. A small genus of terrestrial ferns, very closely related to *Nephrodium,* with which it is perhaps better combined.

(1) **M. triphyllum** Swartz. Rhizome wide-creeping, the younger part scaly; stipes slender, 20 to 30 cm. high, stramineous, slightly pubescent; fronds simple, oblanceolate, 10 to 15 cm. high, 1, 5 to 2 cm. broad, acute, repand, auricled at the base; or the auricles becoming free, as distinct

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pinnules, herbaceous, slightly pubescent on the veins beneath; areolæ 5 to 9 between costa and margin. The simple form is *M. simplex* Hooker.

Isabela-Luzon, *Warburg* 11609; Leyte, *Cuming* 299; Negros, *Copeland* 76.

India to Java and Formosa.

(2) **M. cuspidatum** Blume. Stipe 30 to 100 cm. high, brownish, naked; frond 40 to 100 cm. high, with few scattered pinnæ, the terminal like the lateral; pinnæ erecto-patent, about 15 cm. long by 3 cm. broad, caudate-acuminate, usually falcate at the end, nearly entire, short stalked or sessile, subcoriaceous, glabrous or nearly so, dark green above, with rows of light or reddish dots marking the excurrent veinlets. This species is very near *Nephrodium urophyllum*, but must be specifically distinct even if the genera were united.

Luzon, *Cuming* 178; Mount Mariveles, *Whitford* 272; Leyte, *Cuming* 314; Mindoro, *Cuming* 361.

Himalayas, Java.

(6) ASPIDIUM Swartz.

Fertile and sterile fronds alike or nearly so, inclined toward a triangular shape, and the pinnæ toward a stronger development of the basiscopic side; texture moderately thin; veins anastomosing irregularly, usually very copiously, with or without free included veinlets; sori nearly always round, on a distinct receptacle; indusium peltate, reniform or wanting. An almost exclusively tropical genus of terrestrial ferns, whose greatest development is reached in this region; intimately related, through *Pleocnemia*, to *Nephrodium*. The most of our species seem to be of very local occurrence, and not even locally abundant; the number of species still to be discovered is therefore probably large. The arrangement of the species adopted here is probably artificial, and it is therefore undesirable to raise any of these groups (unless it be *Pleocnemia*) to generic rank.

1. Veins anastomosing very copiously.
   2. Indusium wanting, *Arcypteris*.
      3. Fronds simple.
         4. Lowest lobes entire ..... (1) *A. Bryanti*
         4. Lowest lobes forked or lobed..... (2) *A. Barberi*
      3. Fronds pinnate.
         4. Sori in rows along main veins.
            5. Pinnæ mostly entire ..... (2) *A. Barberi*
            5. Pinnæ pinnatifid ..... (3) *A. macrodon*
         4. Sori strictly marginal ..... (4) *A. Brogniartii*
         4. Sori scattered.
            5. Pinnæ entire or once forked..... (5) *A. lamaoense*
            5. Pinnæ pinnately lobed.
               6. Veinlets inconspicuous ..... (6) *A. difforme*
               6. Veinlets very conspicuous above ..... (7) *A. Whitfordi*
   2. Indusium reniform, *Sagenia*.
      3. Sori in rows along main veins.
         4. Frond not compound.
            5. Rhizome erect ..... (8) *A. heterodon*
            5. Rhizome creeping ..... (9) *A. decurrens*

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4. Frond pinnate.
5. Margin of pinnæ nearly entire.
6. Apex of frond entire ..... (10) *A. persoriferum*
6. Apex pinnatifid ..... (11) *A. pachyphyllum*
6. Apex trifid ..... (12) *A. grande*
5. Pinnæ pinnatifid.
6. With free included veinlets.. (13) *A. siifolium*
6. Without free included veinlets ..... (14) *A. cicutarium*
3. Sori scattered.
4. Frond simple, pinnatifid ..... (15) *A. vastum*
4. Frond pinnate.
5. Terminal pinna deeply pinnatifid.. (16) *A. melanocaulon*
5. Terminal pinna lobed at base..... (17) *A. irriguum*
5. Terminal pinna merely sinuate.... (18) *A. Menyanthidis*
2. Indusium peltate, *Tectaria*.
3. Lowest pinnæ forked ..... (19) *A. repandum*
3. Lowest pinnæ pinnate ..... (20) *A. calcareum*.
1. Veinlets forming costal areolæ, and a few others along the main veins, *Pleocnemia*.
2. Caudex not subarborescent.
3. Sori round.
4. Indusium peltate ..... (21) *A. membranaceum*
4. Indusium reniform.
5. Frond bi-tripinnate ..... (22) *A. giganteum*
5. Frond simple ..... (23) *A. heterophyllum*
3. Sorus oblong ..... (24) *A. ambiguum*
2. Caudex subarborescent ..... (25) *A. leuzeanum*

(1) **A. Bryanti** Copeland. Stipe 20 to 40 cm. high, bearing sparse horizontal scales on the back, and on each side a uniform wing 1 cm., more or less, broad, which is truncate near the base of the stipe; frond 30 to 50 cm. high, ovate, trifid with close lateral lobes or more often quinquefid with the lower lobes remote and connected by a broad wing; apical segment 20 to 30 cm. high, about 10 cm. broad, acuminate, entire or subrepand, papyraceous, glabrous; lateral segments similar but smaller; primary veins curved, almost reaching the margin, connected by conspicuous, arched cross-veinlets, the large, regular areolæ thus formed divided into small, irregular ones with free included veinlets; sori mostly in rows along the main veins; indusium none or fugacious.

Terrestrial in forest near Gimogon River, Negros, *Copeland* 82.

(2) **A. Barberi** (Hooker). Stipes tufted, 15 to 30 cm. high, slightly scaly at the base; frond palmately 5-lobed, or more usually pinnate with a large terminal segment and 1 to 4 pairs of pinnæ, the upper ones oblong-lanceolate, 10 to 15 cm. long, 2 to 3 cm. broad, nearly entire, the lowest pair with a deep lanceolate lobe at the base on the lower side, subcoriaceous, glabrous; areolæ rather large and regular, with copious free veinlets; sori copious, principally in two rows near the main veins.

Majayjay, *Loher*.

Malaya.

(3) **A. macrodon** (Reinw.) Diels. Rhizome decumbent; stipe 30 cm. or more high, slightly scaly below; frond 60 to 100 cm. high, half as broad, the apex deeply pinnatifid, below this numerous lanceolate pinnæ, the lowest sometimes 30 cm. long, deltoid, cut down to a narrow wing

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into pinnatifid, close, lanceolate pinnules, thin, glabrous; areolæ copious, without free veinlets; sori small, in rows near the main veins.

Luzon, *Cuming* 9, 114.

Malaya and Polynesia.

(4) **A. Brogniartii** (Bory) Diels. Rhizome short, erect, densely scaly at the top; stipe 30 cm. or more high, dark brown at the base, lighter above and glabrous; frond 50 to 100 cm. high, half as broad, apex pinnatifid into deep, repand or lobed segments; below this numerous distinct pinnæ, the lowest 15 to 20 cm. long, lanceolate-deltoid, lobed throughout into broadly lanceolate lobes of which all except the lowest basipetal one are entire or nearly so, subcoriaceous, glabrous; areolæ copious, with few or no free veinlets; sori rather small, quite confined to the margin.

Rizal, *Loher;* Albay, Camarines and Masbate, *Baranda;* Negros, *Copeland.*

Malaya.

(5) **A. lamaoense** Copeland. Rhizome ascending; stipe 15 to 25 cm. high, with a few small, lanceolate scales at the base, fibrillose near the top, like the rachis; frond 15 to 25 cm. high, deltoid, usually trifoliate, with a deeply tripartite apical segment, less often with the apical segment entire, or with an extra pair of entire pinnæ intercalated; lowest pinnæ short-stalked, about 10 cm. long, furcate with the smaller, lower segment distant, herbaceous, glabrous, margin entire; areolæ with free veins; sori copious, irregularly scattered, round or elongate, exindusiate, bright, deep red.

On bowlders in creek bed, Lamao Forest Reserve, Luzon, *Copeland* 223. This may not be distinct from *A. irriguum.*

(6) **A. difforme** Blume. Stipes tufted, erect; 30 cm. or more high, scaly near the base; frond 1 m., more or less, high, at least half as broad; upper pinnæ lanceolate, nearly entire or with broad obtuse or falcate lobes reaching half way to the costa; lower pinnæ often deltoid, with the lobes of the lower side prolonged and pinnatifid, subcoriaceous, glabrous; areolæ copious with few free veinlets; sori very copious, scattered.

Isabela-Luzon, *Warburg* 11589; Rizal and Laguna, *Loher;* Culion, *Merrill* 665; Davao, *Warburg* 14132.

Malaya.

(7) **A. Whitfordi** Copeland. Rhizome suberect, very short, densely scaly at the apex; stipe 20 to 30 cm. high, dark brown at the base and clothed with linear scales, lighter above and glabrous; frond 30 to 40 cm. high, deltoid, acuminate, papyraceous, glabrous, olive green, the white veins conspicuous on the upper surface; apex pinnatifid, the segments broadly crenate and obscurely serrate; below this about 6 free pinnæ on each side, erecto-patent, acuminate, lanceolate, pinnatifid more or less than half way to the rachis into oblong, obtuse, entire or serrate lobes, lower pinnæ stalked; lowest ones deltoid, with one free basiscopic pinnule resembling one of the upper pinnæ; veins laxly anastomosing, without free included veinlets; sori round or oblong, irregularly scattered but wanting near the costa, exindusiate.

Lamao Forest Reserve, near the river, Luzon, *Whitford* 201.

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(8) **A. heterodon** Copeland. Rhizome short, erect, woody; stipe 15 to 20 cm. high, glabrescent, bearing on each side a wing about 5 mm. broad at the top, attenuate to the base; frond 20 to 30 cm. high, 3 or 5 partite, herbaceous, glabrous; apical segment oblanceolate, 4 to 5 cm. broad, acuminate, serrate with irregular teeth 0 to 10 mm. long; lateral lobes smaller, erecto-patent, less conspicuously serrate; primary veins reaching the margin; areolæ irregular with free included veinlets; sori large, in rows along the main veins; indusium reniform, persistent.

Terrestrial in forest near Catalonan, Davao, *Copeland* 951.

(9) **A. decurrens** Presl. Rhizome creeping; stipe with a few scattered paleæ, and on each side a wing 5 to 10 mm. broad at the top attenuate almost to the base; frond 50 to 100 cm. high, 30 cm. or more broad, cut down to a broadly winged axis into 4 to 8 pairs of usually crenate lanceolate segments 10 to 20 cm. long the lowest of which are sometimes forked, herbaceous, glabrous; main veins distinct to the margin; areolæ copious, with free included veinlets; sori large, in regular rows along the main veins; indusia reniform.

Luzon, *Cuming* 148; Rizal, *Loher;* Sorsogon and Catanduanes, *Baranda;* Mindoro, *Merrill* 1773; Davao, *Copeland* 967.

India to Polynesia.

(10) **A. persoriferum** Copeland. Rhizome short, ascending; stipe 40 to 60 cm. high, stramineous or brown, clothed at the base with lanceolate, arcuate paleæ 12 mm. long, glabrous above, like the rachis; frond 30 to 50 cm. high, ovate, pinnate, the sterile the more ample; apical part about 25 cm. high, 7 cm. broad, acuminate, entire or subrepand, subcoriaceous, glabrous; lateral pinnæ about 3 pairs, sessile, erecto-patent, subarcuate, lanceolate, 15 to 20 cm. long; fertile pinnæ smaller, about 10 cm. long, 2 cm. broad, obscurely crenate, the lowest stalked; main veins almost reaching the margin; areolæ irregular with free included veinlets; sori in rows along the main veins, almost covering the entire lamina; indusium reniform, very persistent.

River bank near Catalonan, Davao, *Copeland* 929.

(11) **A. pachyphyllum** Kunze. Rhizome short, apparently erect; stipe 30 cm. or more high, brownish, naked; from 60 to 100 cm. high, half as broad, with a subdecurrent terminal part deeply pinnatifid at its base and entire or sinuate above, and 4 to 8 erecto-patent lateral pinnæ on each side, acuminate, subcoriaceous, glabrous, the lower ones with a long fork on the lower side; main veins almost reaching the margin; free included veinlets copious; sori large, in fairly regular rows; indusium reniform. (*A. platyphyllum* Presl.)

Cuming, Luzon, 224; Cebu, 339 and 340; Panay (?) 356 in part; Mindanao, 290; Benguet, *Topping* 337, 338; *Elmer*, 6171.

Malaya and Polynesia.

(12) **A. grande** J. Sm., Mett. Stipe rufescent, shining; frond 1 m. high, pinnate; apex deeply 3-lobed, composed of "three confluent pinnæ;" pinnæ 5 to 6 pairs, 25 cm. long, 6 cm. broad, oblong-lanceolate, caudate-acuminate, subsinuate, membranaceous, glabrous, the lowest stalked,

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cuneate at the base, unequally bipartite; venation of Drynaria; sori in rows close to the main veins, large; indusium reniform, plane, coriaceous.

"Luzon?" *Cuming s. n.*, or No. 356 fide Baker, or Panay, *s. n.*, fide Presl sub. *A. grandifolio.*

The description does not show wherein this is sufficiently distinct from *A. pachyphyllum.*

(13) **A. silfolium** (Willd.) Mett. Stipe 30 cm. or more high, brownish, naked; frond 30 cm. or more high, 15 to 20 cm. broad, with a broad, oblong, acuminate terminal pinna, and 3 to 4 lateral ones on each side, the lowest stalked, 8 to 10 cm. long, 5 cm. broad, forked at the base and rather deeply lobed, subcoriaceous; main veins close, distinct to the margin; areolæ fine, with free included veinlets; sori large, in rows close to the main veins, often confluent.

Luzon, *Cuming* 4.[1]

Java and Sumatra.

(14) **A. cicutarium** (L.) Sw. Rhizome ascending; stipe 30 cm. or more high, bearing scattered deciduous, spreading paleæ; frond 80 cm. more or less high, subdeltoid, apex deeply pinnatifid; below this, 3 to 6 pinnæ on each side, papyraceo-herbaceous or subcoriaceous, glabrous unless on the midribs, the lowest pinnæ subdeltoid, deeply pinnatifid or pinnate below; main veins distinct to near the margin; areolæ with few or no free included veinlets; sori rather large, in rows near the main veins; indusium round-reniform.

Isabela-Luzon, *Warburg* 11973; Mount Mariveles, *Loher, Copeland* 217; Davao, *Warburg* 14166.

Pantropic. Exceedingly variable.

(15) **A. vastum** Blume. Rhizome creeping; stipes scattered, narrowly winged often nearly or quite to the base; frond 1 m., more or less, high, 30 cm. or more broad, cut down to the very broadly winged rachis into entire, linear-oblong segments 15 to 30 cm. long, 3 to 5 cm. broad, papyraceo-herbaceous or subcoriaceous; main veins distinct three-fourths of the way to the margin; areolæ copious, with free included veinlets; sori small, scattered.

Panay, *Cuming* 356 in part.

India and Malaya.

(16) **A. melanocaulon** Blume. Rhizome ascending; stipe 30 cm. or more high, ebeneous, glossy, scaly at the base; frond 30 to 60 cm. high, ovate-deltoid, with a large, deeply pinnatifid terminal pinna, and 1 to 4 lateral ones on each side, the central one deeply pinnatifid with ovate-acuminate lobes, the lowest stalked, 15 to 30 cm. long, 10 to 15 cm. broad, often again pinnate at the base, papyraceo-herbaceous; main veins reaching the margin; areolæ fine, with free included veinlets; sori numerous, minute, scattered; indusium fimbriate, fugacious.

Luzon, *Cuming* 57.

Malaya.

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[1] This is inserted here on the authority of the *Synopsis Filicum*, p. 299. A sterile frond in our herbarium strongly suggests *Arcypteris*, and both Smith and Hooker (Sp. Fil. V:86) treated this plant as exindusiate.

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(17) **A. irriguum** J. Sm., Presl. Stipes tufted, 10 to 15 cm. high, grayish, finely villose; frond 15 to 25 cm. high, 10 to 15 cm. broad, subdeltoid, with a large oblong, terminal pinna with a pair of deep lanceolate lobes at the base, and below this 1 to 2 pairs of slightly sinuate lateral pinnæ, the lowest forked at the base, papyraceo-herbaceous; main veins flexuose; areolæ fine, with free included veinlets; sori small, scattered, often confluent; indusium small, fugacious.

Luzon, *Cuming* 31; Rizal, *Loher*.

(18) **A. Menyanthidis** Presl. Rhizome creeping; stipe 15 to 30 cm. high, brownish, naked; frond 30 to 60 cm. high, 30 cm. or more broad, with an acuminate, oblong-lanceolate, sinuate terminal pinna 15 to 30 cm. long, 2 to 4 cm. broad, and 2 to 4 similar ones on each side, the lowest stalked, sometimes forked, subcoriaceous; main veins, close, conspicuous, reaching the margin; areolæ fine, with copious free veinlets; sori small, scattered, all on the connected veinlets.

Sorsogon, *Haenke;* southern Camarines, *Cuming* 183 in part; Sorsogon, *Baranda*.

New Guinea, Solomon Islands.

(19) **A. repandum** Willd. Stipe 30 to 60 cm. high, grayish brown, naked; frond 60 cm. or more high, 30 to 45 cm. broad, the apex deeply pinnatifid, with linear-oblong, slightly sinuate lobes; below this 4 to 8 pinnæ on each side, 15 to 20 cm. long, about 3 cm. broad, acuminate, narrowed to the base, sinuate, subcoriaceous, the lowest stalked and forked; main veins distinct to the margin; areolæ copious with free veinlets; sori in distinct rows near the main veins; indusium orbicular, peltate, 1 mm. broad.

Luzon, *Cuming* 183 in part; Sorsogon and Catanduanes, *Baranda*.

(20) **A. calcareum** Presl. Rhizome subcreeping; stipe 10 to 15 cm. high, naked; frond 30 cm. or more high, ovate-lanceolate, with acuminate pinnatifid apex, and below it 4 to 6 distant, stalked pinnæ on each side, the lowest deltoid, 15 cm. long, cut down to the rachis below into stalked lanceolate-acuminate, deeply and obtusely lobed pinnules, subcoriaceous; areolæ not very abundant and mainly costular; indusium orbicular.

Leyte, *Cuming* 310.

(21) **A. membranaceum** Hooker. Rhizome ascending, with a mass of black paleæ at the apex; stipes tufted, about 30 cm. high, nearly naked, with a few spreading linear paleæ below; frond about as high as the stipe, deltoid, acuminate, membranous, puberulous especially beneath; upper part subbipinnatifid, free pinnæ 5 to 7, lowest much the largest, subdeltoid, 10 to 20 cm. long, pinnules on the lower side much the larger, pinatifid into obong, entire or crenate segments; veins anastomosing principally in costal arches; sori copious, mostly marginal in the lobes.

"Philippines," *Cuming;* Arayat, 800 m., *Loher;* Davao, *Copeland* 898.

China, Formosa, Java, Ceylon.

(22) **A. giganteum** Blume. Stipe 30 to 60 cm. high, brown, glossy; frond 30 to 60 cm. high, broadly deltoid, with pinnatifid apex and 4 to 5 pairs of pinnæ of which the upper are decurrent, the lower stalked;

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lowest pinnæ very large, obliquely deltoid, pinnules on its basiscopic side prolonged, and at least deeply pinnatifid in turn; veinlets anastomosing at least near the midribs, without sterile included veinlets; indusia subcordate. I suppose that *Nephrodium* (*Pleocnemia*) *giganteum* Baker is our Philippine plant; if it is distinct from *A. giganteum* Blume, Baker's name can not stand.

Leyte, *Cuming?;* Camarines and Albay, *Baranda.*

(23) **A. heterophyllum** Mett. Rhizome creeping; stipe 5 to 10 cm. high, densely villous; frond 10 to 15 cm. high, linear-oblong, simple, with obtuse, oblong, slightly falcate lobes reaching one-fourth of the way to the costa, coriaceous, villous on both surfaces, but especially on the margin and costa beneath; anastomoses of the veinlets not very regular, but suggesting Goniopteris; sori midway the veins and the margin of the lobes. Apparently related to *Nephrodium canescens.*

Samar, *Cuming* 322.

(24) **A. ambiguum** (Hooker) Diels. Stipe slender, nearly naked; frond 40 to 60 cm. high, 30 cm. broad, oblong-deltoid, bipinnatifid; pinnæ lanceolate, 10 to 15 cm. long, 3 cm. broad, the lower ones slightly stalked, cut half way or more to the rachis into linear-oblong lobes, the fertile ones contracted, thinly herbaceous, dark green, rachis and both sides thinly clothed with long, jointed hairs; veinlets of the lobes often forked, the lower ones forming costular areolæ; sori oblong, confluent when the veins fork; indusium none.

Luzon, *Cuming* 154 (Samar, *Cuming* 321?).

(25) **A. leuzeanum** (Presl) Kunze. Rhizome erect, usually short but sometimes arborescent, densely scaly at the crown; stipe 1 m., more or less, long, stout, striate; frond 1 to 2 m. long, subdeltoid; pinnæ 30 to 50 cm. long, 15 to 25 cm. broad, upper ones simple, lowest ones pinnate on the basiscopic side, and the large pinnules pinnatifid; segments 10 cm. long, 2 to 3 cm. broad, subfalcate, entire or sinuate; veinlets anastomosing sparsely and irregularly, rarely free; sori in single close rows; indusia orbicular-cordate, fugacious.

Luzon, *Cuming* 33, 34, 107; Rizal and Laguna, *Loher;* Mindanao, *Cuming* 289.

India and China to Polynesia.

(7) POLYBOTRYA H., B. and K.

Fronds at least pinnate, the fertile much contracted; veins free in the Philippine species; sori originating in a receptacle on the veins, almost or entirely covering the under surface, exindusiate. Our species are rather small terrestrial ferns.

1. Pinnæ not articulate to rachis.
   2. Setæ projecting between teeth ..... (1) *P. appendiculata*
   2. Without setæ.
      3. Frond bipinnatifid ..... (2) *P. stenosemioides*
      3. Frond bi- or tripinnate..... (3) *P. apiifolia*
1. Pinnæ articulate to rachis ..... (4) *P. articulata*

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(1) **P. appendiculata** (Willd.) Blume. Rhizome short, creeping; stipe of sterile frond 10 to 20 cm. high, of fertile 20 to 40 cm., erect, scaly throughout, as is often the rachis; sterile frond 40 to 70 cm. long, apex usually rooting; pinnæ about 5 cm. long in the middle of the frond, horizontal, lanceolate, acute, simply or doubly serrate with the tip of a vein excurrent from the sinus between each two main teeth, abruptly contracted at the base, sometimes auricled on the upper side, papyraceous, glabrous; fertile frond shorter and narrower, with obtuse pinnæ, the lower ones stalked; pinnæ often rolled up in fruit and appearing to be entirely covered by the sori.

Mount Arayat, *Loher;* Benguet, *Topping* 340, *Elmer* 6457; Mount Mariveles, *Warburg* 12508, *Copeland* 245.

India and Malaya, Hongkong.

(2) **P. stenosemioides** Baker sub Achrosticho. Stipes high, chestnut, with a few lanceolate scales toward the base; sterile frond 30 to 45 cm. high, 20 cm. broad, bipinnatifid, submembranaceous, glabrous except for a few deciduous hyaline paleæ on the margin; pinnæ sessile, 10 cm. long, 3 cm. broad, numerous, pinnatifid to a broadly winged costa into oblong, obtuse segments .5 mm. broad; fertile frond similar, but with a longer stipe, nearly 60 cm., and smaller and more lax pinnæ.

Rizal, *Loher.*

Sarawak.

(3) **P. apiifolia** Hooker. Rhizome short, stout, erect; stipe of sterile frond 2 to 7 cm. high, of fertile 15 to 20 cm. the former densely, the latter very sparsely fibrillose; sterile frond 8 to 15 cm. high, 4 to 12 cm. broad, bi- or tripinnate; pinnæ close, rhomboidal, they or their divisions more dissected at the base than in the part above, where they are broader, only the lowest pair ever with pinnate pinnules, rather obtuse, with entire or dentate margin, herbaceous, glabrous beneath except on the midribs; ultimate divisions of the fertile frond reduced to isolated orbicular or globose, beadlike bodies 1 to 2 mm. in diameter.

Luzon, *Cuming* 26, *Lobb;* Rizal, *Loher;* Lamao Forest Reserve, *Merrill* 3129, *Barnes* F. B. 73, *Copeland;* Masbate and Bataan Id., *Baranda.*

(4) **P. articulata** J. Sm. Stipe 30 cm. high, firm, erect, nearly naked; sterile frond 30 to 80 cm. high, 20 to 30 cm. broad, bipinnate; pinnæ articulate to the rachis, narrowly lanceolate; pinnules unequal-sided, oblong, obtuse, crenate, auricled on the upper side, subcoriaceous, glabrous; pinnæ of fertile frond 10 cm. long, linear-cylindrical, auricled on the upper side.

Leyte, *Cuming* 296.

Celebes across Melanesia.

(8) STENOSEMIA Presl.

Sterile frond ample, fertile reduced to linear segments, both broadly trifoliate in plan; basiscopic side of lower pinnæ strongly developed; veinlets anastomosing to form areolæ along the midribs and main veins, free toward the margin, without included veinlets; sori eventually covering the dorsal or both surfaces. Indusium none.

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(1) **S. aurita** Presl. Rhizome erect, short; stipe of sterile frond 15 to 20 cm. high, of fertile 20 to 30 cm., ebeneous, bearing a few lax paleæ; sterile frond 8 to 20 cm. high and broad, its central part deeply pinnatifid with entire, or obtusely serrate, lanceolate lobes; lateral pinnæ very unequal sided, with lowest basiscopic segment pinnatifid, membranaceous, glabrous or with scattered hairs, especially on the veins; fertile on the same plan as the sterile, but rather smaller and the segments hardly over 1 mm. broad; terrestrial.

Leyte, *Cuming* 295; Zamboanga, *Copeland* 738; Davao, *Warburg* 14170, *Copeland* 957.

Malaya to Polynesia.

(9) GYMNOPTERIS Bernhardi.

Rhizome usually creeping; frond simple or pinnate, the fertile much contracted; veinlets copiously anastomosing, with, or less frequently without, free included veinlets; sori covering the entire dorsal surface, exindusiate. Mostly terrestrial ferns of small or moderate stature.

1. Sterile frond simple, entire, or nearly so.
    2. Main veins evident nearly to the margin.
        3. Free included veinlets usually wanting ..... (1) *G. linnaeana*
        3. Free included veinlets copious ..... (2) *G. variabilis*
    2. Main veins obscure, short, or none.
        3. Sterile frond about 5 cm. long ..... (3) *G. minor*
        3. Sterile frond 15 cm. or more long.
            4. Rhizome creeping ..... (4) *G. lanceolata*
            4. Rhizome scandent ..... (5) *G. axillaris*
1. Sterile frond typically trifid ..... (6) *G. taccaefolia*
1. Sterile frond typically pinnate.
    2. Lateral pinnæ but one pair ..... (7) *G. flagellifera*
    2. Lateral pinnæ several pairs.
        3. Terminal pinna unlike the lateral.
            4. Fonds 30 cm. or more high.
                5. Terminal pinna entire or sinuate ..... (8) *G. subrepanda*
                5. Terminal pinna pinnatifid ..... (9) *G. repanda*
            4. Fronds rarely 10 cm. high ..... (10) *G. inconstans*
        3. Terminal pinna like the lateral.
            4. Free included veinlets few or none ..... (11) *G. contaminans*
            4. Free included veinlets regularly present.
                5. Primary veins conspicuous ..... (12) *G. costata*
                5. Primary veins obscure ..... (13) *G. presliana*

(1) **G. linnaeana** (Hooker). Rhizome wide-creeping; stipes 5 cm. more or less high, slightly fibrillose below; sterile frond 10 to 20 cm. high, 1 to 2 cm. broad, narrowed gradually to both ends, sometimes rooting at the apex, entire, papyraceous, subopaque, dark green; main veins fine, rather zigzag but distinct nearly to the margin; areolæ copious, without free veinlets; fertile frond hardly 10 cm. long, less than 1 cm. broad.

Rizal, *Loher*. This plant often has a pair of minute free pinnæ at the base of the linear frond; or even the sterile frond pinnate.

Malaya.

(2) **G. variabilis** (Hooker) Bedd. Rhizome wide-creeping; stipe of sterile frond 0 to 10 cm. high, of fertile 30 cm. or more; sterile frond 30

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cm. more or less high, contracted gradually to the base, oblong-spatulate, acute or obtuse, entire, papyraceo-herbaceous, glabrous; main veins prominent, zigzag, reaching nearly to the margin, areolæ copious, with free included veinlets; fertile frond 15 to 30 cm. high, 4 mm. broad.

Davao, *Warburg* 14114.

India and Malaya.

(3) **G. minor** (Mett.) Bedd. (*Dendroglossa normalis* Presl in part.) Rhizome wide-creeping, firm; stipe of sterile frond 2 to 5 cm. high, glabrous, stramineous; of fertile about 10 cm.; sterile frond 3 to 5 cm. high, 1 cm. broad, obtuse, entire, with tapering base, herbaceous, glabrous; no main veins, areolæ and included veinlets copious; fertile frond 3 to 5 cm. high, 3 mm. broad.

Samar, *Cuming* 326 in part.

Khasya hills in India.

(4) **G. lanceolata** Hooker. Rhizome woody, wide-creeping; sterile frond sessile or decurrent on a short stipe, 15 to 30 cm. high, 1 to 3 cm. broad, obtuse or acute, entire, narrowed very gradually below, herbaceous, glabrous; main veins raised but falling short of the margin; areolæ copious, with free veinlets; fertile frond 15 to 30 cm. high, 2 to 4 mm. broad, on a stipe 20 cm. high.

Samar, *Cuming* 326 in part, a small form; Davao, *Copeland* 932.

India and Malaya.

(5) **G. axillaris** (Cav.) Presl. Rhizome wide-scandent, branching; stipe of sterile frond short or none, of fertile about 10 cm. high, slightly scaly at the base; sterile frond 15 to 30 cm. long, 2 to 3 cm. broad, obtuse, entire, tapering gradually to the base, papyraceous, glabrous; no main veins; areolæ very copious, with free veinlets; fertile frond 15 to 30 cm. long, 2 to 6 mm. broad, flexuous.

Luzon, *Nee, Cuming* 30; Albay, *Baranda.*

India and Malaya.

This and the two preceding species are sometimes regarded as forms of *G. variabilis.*

(6) **G. taccaefolia** (Hooker) J. Sm. Rhizome short, stout, creeping; stipe of sterile frond about 10 cm. high, of fertile about 30 cm., both clothed below with narrow, horizontal paleæ; sterile frond 30 cm. more or less long, typically trifid, sometimes simple or pinnate, sometimes rooting at apex, pinnæ acute, entire, lanceolate, rachis winged in the more complex forms and the lowest pinnæ forked, papyraceous, glabrous; main veins distinct nearly to margin, with regular transverse veinlets and copious areolæ with included veinlets; fertile frond typically trifid with middle segment 15 cm. long, the lateral 10 cm., 3 to 4 mm. broad, exceptionally simple or pinnate. This species is regarded as including *Anapausia decurrens* Presl, *Gymnopteris subquinquefida* Presl, and *G. latifolia* Presl.

Luzon, *Cuming* 3 and 5; "Manila," *Meyen, Gaudichaud;* Rizal, *Loher;* Mindoro, *Cuming* 357; Culion, *Merrill* 534.

(7) **G. flagellifera** (Wall.) Bedd. Rhizome short and terrestrial, or scandent up tree trunks when it is scaly and climbs by means of rootlets;

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stipe of sterile frond 5 to 20 cm. high, of fertile 20 to 40 cm., scaly or glabrescent; sterile frond simple, or with 1 to 3 pairs of pinnæ, the terminal one lanceolate, entire, repand or subserrate, often elongate and rooting, lateral ones more or less reduced, herbaceous, glabrous; main veins distinct, areolæ of various forms, with few or no included veinlets; fertile fronds usually trifoliate or pinnate, 3 to 10 cm. long, lanceolate. This species is well distinguished from the preceding by the venation and the longer, more slender rhizome. This species includes *Poecilopteris heteroclita* Presl and *P. diversifolia* Presl.

Isabela-Luzon, *Warburg* 11603; "Manila," *Haenke, Cuming* 32; Sorsogon, *Haenke, Baranda;* Davao, *Copeland* 671, 752, 950.

India and Malaya.

(8) **G. subrepanda** (Hooker) J. Sm. Rhizome woody, wide-creeping; stipe 15 to 30 cm. high, stout, erect, nearly naked; sterile frond simple and 30 cm. long by 3 to 5 cm. broad, or pinnate, and 60 cm. long by 30 cm. broad, with several pairs of linear-oblong, entire or subrepand pinnæ, subcoriaceous, glabrous; main veins distinct nearly to margin; areolæ and included veinlets copious; fertile frond like the sterile, but smaller.

Luzon, *Cuming* 225; Isabela-Luzon, *Warburg* 11622.

Penang.

(9) **G. repanda** (Blume) Christ. Rhizome creeping; stipe 15 to 30 cm. high, that of the sterile frond usually the longer, naked; sterile frond 30 to 60 cm. long, 20 to 30 cm. broad, sometimes elongate and rooting, with numerous pinnæ on each side, the lower ones 10 to 15 cm. long, 2 cm. broad, cut one-fourth of the way to the costa into entire, obtuse lobes, herbaceous, glabrous; main veins distinct, areolæ copious, without free veinlets; fertile pinnæ much smaller, stalked, entire or repand. *Achrostichum Quoyanum* Gaud. is a form with the lobes deeper and toothed. This species is construed as including also *Poecilopteris sinuosa* Presl, *Heteroneuron argutum* Fée, and *Heteroneurum cuspidatum* Presl.

Luzon, *Cuming* 104, 105, 161; Sorsogon, *Haenke;* Leyte, *Cuming* 294.

Java to China and Polynesia.

(10) **G. inconstans** Copeland. Rhizome creeping, scaly; stipe of sterile frond 1 to 3 cm. high, of fertile 3 to 10 cm., filiform, erect, green, glabrous or scaly below; sterile frond 4 to 8 cm. or more long, usually pinnate, linear to ovate in form, membranaceous, glabrous, the terminal pinna usually elongate, linear, proliferous; lateral pinnæ 2 to 6 pairs, lanceolate to orbicular in form, usually entire, sessile, somewhat decurrent; veins inconspicuous, forming few areolæ, without included veinlets; fertile frond linear, with 2 to 4 pairs of round or oblong remote pinnæ 1 to 4 mm. long, the lowest sometimes stalked, with few or no veins beside the costa.

Lamao Forest Reserve, Luzon, *Copeland* 251, *Merrill* 3128.

Completely covering bowlders in beds of streams.

(11) **G. contaminans** (Wall.) Bedd. Rhizome short-creeping, thick; stipe 30 to 40 cm. high, glabrescent; sterile frond 30 to 60 cm. high, ovate; pinnæ 10 or more on each side, alternate, sessile or short-stalked, lanceolate, acute, entire, crenate or pinnatifid; terminal pinna commonly

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elongate and proliferous; main veins evident about half way to margin, areolæ large, with few included veinlets; fertile pinnæ much contracted, entire or sinuate. This partly includes *Achrostichum blumeanum* Hooker.

Luzon, *Cuming* 223, 225; Rizal, *Loher;* Lamao, *Copeland* 249.

India, Burmah.

(12) **G. costata** (Wall.) Bedd. Rhizome creeping, bearing subulate scales; stipe 45 cm. or less high; frond 60 cm. or more long; pinnæ reaching a length of 35 cm. and a breadth of 8 cm., stalked, acuminate, entire, sinuate or crenate, subcoriaceous, glabrous; main veins very prominent, close; areolæ and included veinlets copious; pinnæ of fertile frond smaller and more coriaceous.

"Manila," *Gaudichaud.*

Upper India, Burmah.

(13) **G. presliana** (Fée). Rhizome woody, short-creeping; stipe 10 to 20 cm. high, firm, erect, naked; sterile frond about 30 cm. long, half as broad, with numerous erecto-patent pinnæ 5 to 8 cm. long, 1 cm. broad, entire, narrowed to both ends, submembranaceous, glabrous, lower ones short-stalked; rachis winged above; venation as in *Goniophlebium*, veinlets uniting in pairs, with one free veinlet in each areola; fertile fronds usually with longer stipes and pinnæ much contracted.

Sorsogon, *Haenke.*

India.

(10) **DIPTERIS** Reinwardt.

Rhizome creeping, stipes not articulate to it; frond cleft to the base into parts, which are dichotomously divided or lobed; main veins dichotomous; veinlets anastomosing, with free included veinlets; sori small, round, mostly along the main veins and cross veins, without indusia. Striking terrestrial ferns of large size, fan-shaped or reniform in general outline.

(1) **D. conjugata** (Kaulf.) Reinw. Rhizome covered with dark brown, linear scales; stipe usually 1 m. or more high, firm, brown, naked, polished; frond usually more than 30 cm. high and much broader, the halves lobed at least two-thirds of the way down, their divisions successively more shallowly, segments acute, coarsely or obscurely serrate, subcoriaceous, glabrous, dark green above, glaucous and bluish beneath; main veins very conspicuous, areolæ copious.

Luzon, *Cuming* 155, *Steere;* Benguet, Mariveles, and Laguna, *Loher;* Baguio, *Topping* 164, 238, *Elmer* 5782; Mount Mariveles, *Merrill* 3228, *Whitford* 250; Davao, *Warburg* 14185.

Malaya to Formosa and Polynesia.

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III. DAVALLIEÆ.

Sori (except in *Oleandra*) terminal on their veins, on or near the margin of the frond; indusium opening toward the margin (wanting in *Monachosorum*); margin of frond often modified in connection with sorus; stipes articulate to rhizome, or not; fronds usually at least deeply pinnatifid; pinnules of segments usually more developed on the acropetal side.

1. Pinnæ not dimidiate, i. e., the lamina is more or less developed on both sides of the costa.
   2. Sori separate and distinct.
      3. Indusium fastened at the base only.
         4. Pinnæ articulate to the rachis.
            5. Stipe articulate to rhizome ..... (11) *Arthropteris*
            5. Stipe not articulate to rhizome.. (12) *Nephrolepis*
         4. Pinnæ not articulate to the rachis, or frond simple.
            5. Stipe articulate to rhizome.
               6. Sori dorsal on veins, near costa ..... (13) *Oleandra*
               6. Sori marginal or submarginal ..... (14) *Humata*
            5. Stipe not articulate to rhizome.. (15) *Saccoloma*
      3. Indusium fastened at base and sides.
         4. Stipe articulate to rhizome ..... (16) *Davallia* / *Microlepia ciliata*
         4. Stipe not articulate to rhizome.
            5. Margin of frond hardly modified.
               6. Ultimate divisions of frond not cuneate nor sori marginal ..... (17) *Microlepia*
               6. Ultimate divisions cuneate, with sori on the broad apex ..... (18) *Odontosoria*
            5. Margin united with indusium to form a cup-shaped receptacle.. (19) *Dennstaedtia*
      3. Indusium wanting ..... (20) *Monachosorum*
   2. Sorus continuous around the pinna..... (21) *Schizoloma*
1. Pinnæ dimidiate, lower half obsolete..... (22) *Lindsaya*

(11) ARTHROPTERIS J. Smith, Diels.

Rhizome scandent, stipes articulate to it or a little above it; frond pinnate, the pinnæ articulate to the rachis; sori orbicular, indusium round-reniform, fixed by the sinus, or (not in Philippine species) wanting. A small genus very near Nephrolepis.

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(1) **A. glabra** Copeland. Rhizome wiry, climbing 3 m. high on tree trunks, sparsely clothed with black appressed scales or their bases; stipes about 5 mm. high, articulate well above the rhizome; frond 20 to 30 cm. high, 5 to 7 cm. broad, pinnate, with a terminal pinna rather larger than the others; lateral pinnæ about 8 mm. broad, obtuse, or the upper ones subacute, obscurely crenate, slightly auricled, the upper side abruptly truncate, the lower very oblique at the base, papyraceous, glabrous, remaining green when dried; sori orbicular, in a row a little nearer the margin than the costa; indusium fixed by a very narrow sinus, persistent.

E-wi-ig River, Paragua, *Merrill* 740.

(2) **A. ramosa** (Beauv.) J. Sm. Stipes very short, scattered, on a slender, wiry, wide-creeping rhizome; frond 15 to 30 cm. long, 3 to 7 cm. broad; pinnæ 1 to 3 cm. long, 1 cm. broad, slightly crenate, the upper edge auricled and truncate, parallel with the stem, the lower oblique; texture papyraceous; rachis and both sides slightly villose, the whole plant turning blackish when dried; indusium roundish, very fugacious.

Luzon, *Cuming* 101; Basilan, *Steere*.

Africa to Samoa.

(12) NEPHROLEPIS Schott.

Fronds pinnate; pinnæ articulate to the rachis but rachis not articulate to the rhizome; sori on the back of the pinnæ, near the margin or remote from it, in a row parallel to it, reniform, varying from broadly so to orbicular. The most of our species are terrestrial with erect caudices above the ground, supported by braces which also function as roots and runners.

1. Indusium with broad sinus, opening toward apex of pinna..... (1) *N. cordifolia*
1. Indusium with deep sinus, opening obliquely toward margin.
    2. Rhizome short.
        3. Frond nearly glabrous ..... (2) *N. exaltata*
        3. Frond hirsute ..... (3) *N. hirsutula*
    2. Rhizome scandent ..... (4) *N. volubilis*
1. Indusium orbicular-reniform, attached at top of sinus or subpeltate.
    2. Rachis nearly glabrous, sori far from margin..... (5) *N. acuta*
    2. Rachis tomentose, sori near margin.
        3. Pinnæ hirsute ..... (6) *N. rufescens*
        3. Pinnæ glabrous ..... (7) *N. barbata*

(1) **N. cordifolia** Presl. Caudex suberect or oblique, the wiry fibers from it often bearing tubers; stipes tufted, wiry, 5 to 15 cm. high, naked or scaly; fronds 15 to 40 cm. long, 2.5 to 3.5 cm. broad; pinnæ close, often imbricate, obtuse, entire or nearly so, the base cordate or rounded on the lower side, with a short, sharp auricle on the upper, subcoriaceous, nearly glabrous; sori large, in a row midway between midrib and margin; indusium broad, firm, opening toward the apex of the pinnæ or somewhat obliquely.

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Benguet, *Loher* (altitude, 2,500 m.), *Elmer* 6507 (form with very chaffy stipe and rachis), 6528 (very lax, serrate form, in moist ravines), *Topping* 231; Nueva Ecija, *Merrill* 240; Arayat, 800 m., *Loher;* Mariveles 1,300 m., *Merrill* 3236.

Pantropic.

(2) **N. exaltata** Schott. Stipes tufted, 10 to 15 cm. high, naked or slightly scaly; fronds 30 cm. or more long, about 10 cm. broad; pinnæ close but not imbricate, the fertile linear, acute, usually subfalcate, sterile shorter and less acute, base rounded on the lower side, auricled on the upper, entire or nearly so, subcoriaceous, nearly glabrous; sori submarginal; indusium reniform with a deep sinus.

Sorsogon, *Baranda;* Rizal, *Loher*, *Marave.* A form with repeatedly dichotomous pinnules is common in cultivation in Manila.

Pantropic.

(3) **N. hirsutula** Presl. Like *N. exaltata*, except that both surfaces of the pinnæ, and especially the rachis, are downy.

Bataan Island, *Baranda;* Benguet and Manila, *Loher;* cultivated in Manila.

(4) **N. volubilis** J. Sm. Rhizome scandent indefinitely, naked, pale brown, wiry, bearing small clusters of fronds at the ends of very short branches; stipes about 10 cm. long, firm, naked or nearly so; fronds 25 to 50 cm. long, 4 to 6 cm. broad, the rachis firm, sparsely chaffy on the back; pinnæ about 5 mm. broad, very obtuse, nearly entire, rounded on the lower side at the base, obscurely auricled on the upper, coriaceous, glabrous, or the costa minutely squamulose above; sori near the margin; indusium reniform with a deep sinus.

Luzon, *Cuming* 37; Negros, *Cuming* 346; Davao, *Copeland* 429, common sterile in low thickets.

Himalayas to New Guinea.

(5) **N. acuta** Presl. Rhizome very short, erect, with scaly props; stipes tufted, stout, 30 to 80 cm. high, squamulose at the base, glabrescent above; fronds 80 to 120 cm. high, 30 to 40 cm. broad; pinnæ 15 to 25 mm. broad, separated by less than their own breadth, acute, cuneate or more abruptly contracted at the base, sterile entire, fertile obscurely crenate, herbaceous or subcoriaceous, glabrous or nearly so; sori almost as near the costa as the margin; indusium becoming orbicular by the meeting of the two broad basal lobes. (Includes *N. macrophylla* Presl.)

Luzon, *Cuming* 22, *Steere;* Benguet, *Loher* (altitude, 2,250 m.), *Elmer* 6145; Manila, *Warburg*, *Marave;* Tayabas, *Warburg;* Sorsogon, *Baranda;* Paragua, *Merrill* 725; Basilan, *DeVore* and *Hoover* 86; Davao, *Warburg* 12757, *Copeland* 365, 629.

Pantropic.

(6) **N. rufescens** Presl. Caudex erect, stout, with numerous braces, coated with small black, appressed scales; stipes 20 to 60 cm. high, firm, brown, glabrescent; frond 60 to 100 cm. high; pinnæ 10 to 15 mm. broad, acute, sterile entire, fertile more or less serrate, broadly rounded at the base on the lower side, the upper usually prominently auricled, herbaceous,

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under surface, and still more the rachis, ferruginous-pubescent; sori near the margin; indusium becoming orbicular.

Cagayan-Luzon, *Warburg* 12221; Benguet, *Elmer* 6235, 6469; Topping 211; Sorsogon, *Baranda;* Manila, *Santos, Ramos;* Tayabas, *Merrill* 2438; Mindoro, *Merrill* 884; Davao, *Copeland* 389, 485, 589, the most characteristic plant of the edges of drier thickets.

(7) **N. barbata** Copeland. Rhizome short, suberect, with many fine supporting roots; stipes 10 to 15 cm. high, firm, sparsely scaly at the base, glabrescent above; frond rather more than 50 cm. long, 8 cm. broad; pinnæ, the larger sterile ones 35 mm. long, 10 mm. broad, acute, entire, the fertile 50 mm. long, 7 mm. broad, acuminate, more or less serrate toward the apex, rounded on the lower side at the base, acutely auriculate on the upper, subarcuate, subcoriaceous, glabrous, reduced toward the base of the frond; sori near the margin; indusium orbicular, the lobes overlapping.

Todaya, Davao, epiphytic on tree trunks, *Copeland* 1286.

(13) **OLEANDRA** Cavanilles.

Rhizome creeping or erect, branching, scaly; stipes articulate to projections from the rhizome; fronds simple and entire, lanceolate; veins free, running to the margin of the frond, sori on the backs of the veins, near the costa; indusium reniform, fixed by the sinus, firm. This genus was formerly classed with the *Aspidieæ*, and has lately been separated as constituting an isolated group. It seems to me, however, that the resemblances to various *Davallieæ*, and specially to the simple species of *Humata*—the creeping, scaly rhizome, the articulate stipe, the free, forked, closely parallel veins, the shape, attachment, and texture of the indusium, and its opening obliquely toward the apex of the frond—all these can not well be construed otherwise than as evidences of real affinity; and that, while the position of the sori may well serve as a generic character, it ought not to make us adopt a larger classification that fails to express so many characters in common.

1. Rhizome woody, suberect.
   2. Stipe articulate just below lamina ..... (1) *O. colubrina*
   2. Stipe articulate "below its middle" ..... (2) *O. neriiformis*
1. Rhizome creeping.
   2. Paleæ squarrose ..... (3) *O. Whitmeei*
   2. Paleæ appressed ..... (4) *O. Cumingii*

(1) **O. colubrina** (Blanco) Copeland. Rhizome woody, stout, suberect, branching, clothed with scales whose very narrow spreading tips are deciduous, leaving the persistent, imbricate, peltate bases, black with brown margins; stipe articulate immediately below the lamina; fronds mostly clustered, 15 to 20 cm. long, about 2 cm. broad, widening toward the upper end, then abruptly contracted and caudate, narrowed gradually toward the base, entire, the margin sometimes slightly cartilaginous under the lens, ciliate with whitish hairs, with which the surfaces are sparsely and the costa densely clothed, papyraceous; sori in an irregular row on each side of costa; indusia small, brown with white margins, firm, almost without a sinus.

Mount Mariveles, *Merrill* 3238, *Copeland* 1381, *Whitford* 248.

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(2) **O. neriiformis** Cav. Rhizome woody, mostly erect, branching, clothed with appressed scales; stipe articulate below the middle—that is, longer than the outgrowth of the rhizome that bears it—fronds scattered or clustered, 20 to 40 cm. high, 2 cm. broad, narrowed gradually toward both ends, usually subcoriaceous and glabrous; indusium oblique, large enough to cover sorus. This species is construed as including Presl's *O. mollis*, with pubescent fronds, and *O. macrocarpa*, with large sori and ciliate margin.

Luzon, *Nee*, *Cuming* 94, 60 in part; Baguio, *Elmer* 6286; Davao, *Warburg* 14186.

Pantropic.

(3) **O. Whitmeei** Baker. Rhizome wide-creeping, 2 mm. thick, densely beset with squarrose paleæ 4 mm. long; stipes (including both parts) about 4 cm. high, articulate about the middle; fronds 20 to 30 cm. high, one-tenth as broad, acuminate, narrowed to the base, slightly repand, membranous, glabrous except for fine short hairs along the margin, and narrow scales 2 mm. long standing horizontally from the costa, the latter sometimes deciduous; sori large, almost orbicular, indusium membranous.

Mount Apo, *DeVore* and *Hoover* 364; *Copeland* 1055.

Samoa, Celebes.

(4) **O. Cumingii** J. Sm. Rhizome creeping, 2 mm. thick, densely clothed with appressed lanceolate-subulate scales; stipe (including both parts) about 5 cm. high, articulate below the middle; frond 20 to 30 cm. high, one-tenth as broad, lanceolate, acuminate, contracted rather abruptly at the base, subentire, with narrowly cartilaginous margin, papyraceous, costa and both surfaces slightly pubescent; indusium rough.

Luzon, *Cuming* 60 in part; Baguio, *Elmer* 6513.

India, southern China.

(14) **HUMATA** Cavanilles.

Rhizome creeping, scaly, the stipes articulate to it; sori terminal, at the margin or somewhat remote from it; indusium reniform or more elongate, fixed by its broad base. Mostly small epiphytic ferns, resembling Davallia, from which they are distinguished by the free sides of the (usually broader) indusium.

1. *Euhumata;* indusium thin.
   2. Sterile frond entire.
      3. Fertile frond entire ..... (1) *H. angustata*
      3. Fertile frond lobed ..... (2) *H. heterophylla*
   2. Sterile frond pinnatifid or pinnate.
      3. Lowest segments not greatly enlarged..... (3) *H. gaimardiana*
      3. Lowest segments or pinnæ very large.
         4. Not more than bipinnatifid ..... (4) *H. repens*
         4. At least tripinnatifid.
            5. Sori on the teeth of the segments ..... (5) *H. vestita*; (6) *H. Cumingii*
            5. Sori almost covering segments (7) *H. botrychioides*

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1. *Leucostegia;* indusium thin.
   2. Frond about 2 dm. high, triangular ..... (8) *H. falcinella*
   2. Frond more than 3 dm. high.
      3. Sori 1 to 2 mm. wide ..... (9) *H. immersa*
      3. Sori minute ..... (10) *H. hymenophylloides*

(1) **H. angustata** Wallich. Rhizome wide-creeping, scaly, stout; fronds scattered, short-stalked, about 10 cm. long and 1 cm. broad, apex acute, margin slightly and irregularly crenate, very coriaceous, glabrous or with a few scales on the costa beneath; sori in a row along the edge.

E-wi-ig River, Paragua, *Merrill* 778, on rocks in forest.

Malaya.

(2) **H. heterophylla** (Desv.) J. Sm. Rhizome wide-creeping, scaly; frond shortly stalked, 6 to 10 cm. long, one-fourth as broad, glabrous, coriaceous; the sterile one ovate-lanceolate, entire or slightly lobed at the base, the fertile one narrower, deeply sinuato-pinnatifid; sori 2 to 10 to a lobe.

Maquiling, *Loher;* Samar, *Cuming* 338; E-wi-ig River, Paragua, *Merrill* 763, epiphytic.

Malaya and Polynesia.

(3) **H. gaimardiana** (Gaud.) J. Smith. Rhizome wide-creeping, scaly; stipe about 1 cm. high, scaly or glabrescent; frond 10 to 15 cm. high, 3 to 5 cm. broad, ovate-lanceolate, cut down nearly or quite to the rachis into parallel, entire or crenate, linear-oblong lobes, the lowest pair of which are often deeply incised on their lower side, glabrous, coriaceous; sori oblique, in full rows between midrib and margin.

Luzon, *Cuming* 61; Gimogon River, Negros, *Copeland* 54, in tree tops in the forest.

Malaya and Polynesia.

Our plant is intermediate between *Davallia parallela* Wallich and *D. pectinata* Smith.

(4) **H. repens** (L.) J. Sm. (*Davallia pedata* Smith). Rhizome wide-creeping, scaly; stipe 5 to 10 cm. high, rather scaly; frond 5 to 10 cm. long, 3 to 5 cm. broad at the base, deltoid in general outline, cut down nearly to the rachis; upper segments linear-oblong, acute, erecto-patent, inciso-dentate, the lower pair broader, deeply inciso-pinnatifid, especially on the lower side; texture coriaceous; sori placed in rows on the teeth on both sides of the lobes.

Arayat, *Loher*, *Merrill* 3818, differs from the type in that the sterile frond is smaller and broadly lobed, and the fertile larger and more deeply incised, and the rachis very scaly; Cagayan-Luzon, *Warburg* 12219; Mount Mariveles, *Merrill* 3210, *Forestry Bureau* (*Barnes*) 347, *Copeland.*

India to Japan and Australia.

(5) **H. vestita** J. Sm. Rhizome wide-creeping, densely scaly; stipe about 10 cm. high, rather scaly below; frond 10 to 20 cm. long, 10 cm. broad, deltoid in outline; all except the upper pinnæ cut down to a narrowly winged rachis; barren frond with the segments of all except the lower pinnæ blunt, scarcely toothed; lobes of the fertile pinnæ narrower, sharper toothed; of the lower ones deeply so; texture coriaceous; sori placed on the teeth of the segments.

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Mount Data, 2,250 m., *Loher;* Baguio, *Topping* 199 (?).

Java, Ceylon.

(Probably a mere variety of *H. repens.*)

(6) **H. Cumingii** (Hook.). Rhizome creeping, scaly; stipe 10 cm. high, both it and the rachis rather scaly; sterile frond about 3 cm. each way, deltoid-cordate, cut down nearly to the rachis; upper pinnæ blunt, slightly toothed, the lower pair deeply pinnatifid below; texture coriaceous; fertile frond 10 to 12 cm. long, 8 cm. broad, the same shape, but much more divided; lowest pinnules deeply pinnatifid with sharply toothed lobes; sori placed in the teeth of the segments.

Samar, *Cuming* 138.

(7) **H. botrychioides** J. Sm. Rhizome wide-creeping, scaly; stipe 5 to 10 cm. high, scaly below; frond 6 to 20 cm. long, 5 to 10 cm. broad, deltoid in general outline, decidedly dimorphous, the barren ones with a narrowly-winged rachis; lower pinnæ cut down nearly to the rachis, with deep bluntly-toothed segments; fertile pinnæ much more finely divided; pinnules of the lower pinnæ cut down to a narrow rachis with narrow sharply-toothed segments almost covered with sori.

Tonglon, 2,000 m., *Loher;* Baguio, *Elmer* 5843.

Aneiteum and Fiji.

This and the preceding three species are decidedly too near together. A fern differing from *H. botrychioides* in being less divided grows on Mount Apo, Mindanao (*Copeland* 1030).

(8) **H. falcinella** (Presl). Rhizome wide-creeping, thickly beset with stiff, spreading hairs, ferruginous, turning toward black; stipe 5 to 10 cm. high, glabrous, as is the frond; fronds about 13 cm. high, 10 cm. broad, deltoid, tri- or quadripinnatifid; main rachis slightly winged; lowest pinnæ inequilateral; pinnules oblong, cut down nearly to the rachis into segments which are again deeply toothed, ultimate segments of the fertile frond falcate-mucronate, of the sterile frond broader and not so sharp; texture subcoriaceous; sori 2 to 6 to a lobe, placed at the bases of the teeth; indusium thin.

Leyte, *Cuming* 304; Gimogon River, Negros, *Copeland* 72; epiphytic in forest.

This fern has the aspect of *Eudavallia* and the paleæ of *Microlepia.*

(9) **H. immersa** (Wall.) Diels. Rhizome hypogaeous, wide creeping, stout, fibrillose; stipe 10 to 20 cm. high, erect; frond 30 to 45 cm. long, 15 to 25 cm. broad, deltoid, tripinnate; lowest pinnules lanceolate-deltoid, 5 to 8 cm. long, with broad segments, which are obliquely truncate at the base below, and roundly lobed, with the lobes again crenate above; texture herbaceous; sori large (2 mm. broad), 1 to 6 to a segment, oblique.

Tonglon, 2,250 m., *Loher,* a large form; Baguio, *Topping* 246, 256, 304; *Elmer* 5908. Mount Apo, Mindanao, *DeVore* and *Hoover* 322 (?).

India and Java.

(10) **H. hymenophylloides** (Bl.) (*Davallia affinis* Hook.). Rhizome thick, densely clothed with sharp-pointed ferrugineous scales; stipe 10 to 25 cm. high, erect, strong; frond 30 to 60 cm. long, 15 to 30 cm. broad, deltoid-lanceolate, tri- or quadripinnate; lower pinnules with oblong

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rhomboidal lobes, the segments of which are deeply and finely incisopinnatifid with sharp teeth; texture herbaceous; sori 2 to 6 to a segment, small, placed at the base of the teeth.

Baguio, *Loher*, a large form, with narrow lobes; *Topping* 307 ?.

Cuming's 117 and 215 (*Microlepia tenuifolia* Presl), from Luzon, are probably both this species.

(15) SACCOLOMA Kaulfuss.

Rhizome creeping, scaly, stipe not articulate to it; frond (in our species) finely dissected; sori near, not on, the margin, small, numerous; indusium short, attached by the broad base, thin. Our species is a large terrestrial fern.

S. moluccanum (Bl.) Mett. Rhizome creeping, clothed with large pale-brown scales; stipe erect, about 3 dm. high, sparsely scaly; frond 6 to 10 dm. high by half as broad, quadripinnatifid, deltoid; pinnæ lanceolate; the segments of the pinnules cut down to the rachis into broadly toothed, oblong lobes; texture membranous or subcoriaceous, both surfaces naked or nearly so; sori small, in the teeth, near the base.

Benguet, *Loher* 49, *Elmer* 6289.

Malaya and Polynesia.

(16) DAVALLIA Smith.

Rhizome short or creeping, scaly, the stipes articulate to it; sori at or very near the margin; indusium usually elongate, attached at the base and sides, the margin of the frond often so modified as to resemble it. Mostly epiphytic ferns. The two sections would better be treated as separate genera.

1. *Prosaptia;* fronds elongate, pinnatifid or simply pinnate.
   2. Frond narrowly linear ..... (1) *D. exaltata*
   2. Frond not narrowly linear.
      3. Segments lobed ..... (2) *D. contigua*
      3. Segments nearly entire ..... (3) *D. alata*

1. *Eudavallia;* fronds deltoid, at least tripinnatifid (except *D. wagneriana*).
   2. False veins present between the true ones.
      3. Sori flanked by prominent teeth ..... (4) *D. epiphylla*
      3. No prominent teeth ..... (5) *D. elegans*
   2. No false veins.
      3. Sori marginal.
         4. Paleæ of rhizome brown ..... (6) *D. solida*
         4. Paleæ whitish ..... (7) *D. bullata*
      3. Sori not reaching the margin.
         4. Distinctly deltoid ..... (8) *D. decurrens*, (9) *D. divaricata*
         4. Lowest pinnæ not enlarged ..... (10) *D. wagneriana*

(1) **D. exaltata** Copeland. Rhizome short, densely invested with linear brown chaff; fronds sessile, crowded, pendent, half a meter long and less than a centimeter wide, the lower third sterile, pinnatifid almost to the rachis, the lower segments reduced; segments inequally triangular, coriaceous, obtuse, plane, glabrous; veins invisible; sori solitary in the apices of the segments.

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Mount Apo, Mindanao, *Copeland* 1006, on tree trunks, in the mossy forest, at an altitude of 1,800 m.

(2) **D. contigua** Swartz. Fronds tufted, sessile or nearly so, 30 to 45 cm. long, about 3 cm. broad, linear-lanceolate, cut down nearly or quite to the rachis into numerous linear-acuminate or bluntish, slightly-toothed lobes; texture coriaceous; sori 1 to 8 to a lobe, placed in the teeth on their upper part.

Luzon, *Cuming* 216; Benguet, *Elmer* 6275; Davao, *Copeland* 1013, *DeVore and Hoover* 335.

Ceylon to Polynesia.

(3) **D. alata** Bl. (*D. Emersoni* Hk. and Gr.) Rootstalk erect, short, scaly; fronds tufted, sessile, 20 to 30 cm. high, 3 cm. wide at the widest part, linear-lanceolate, cut more than half way down to the rachis into numerous linear-oblong, or at the lower part triangular, lobes; texture coriaceous, minor veins invisible; sori 1 to 8, placed round the edge of the lobes.

Mount Mariveles, *Topping*.

India to Borneo.

(4) **D. epiphylla** Bl. Rhizome thick, fibrillose; stipe 10 to 50 cm. long, erect, firm; frond variable in size, deltoid-lanceolate, tri-quinque-pinnatifid; main rachis hardly at all winged; pinnules of the lowest pinnæ lanceolate, segments narrow, mucronate, sharply toothed; texture coriaceous; veins not immersed, one or two carried into each tooth; sori small, submarginal, half-cupshaped, with the sharp mucro of the tooth extending beyond them.

Davao, *Warburg* 14138, *Copeland*.

Java and Malay Peninsula.

Not sufficiently distinct from *D. elegans*.

(5) **D. elegans** Swartz. Rhizome stout, creeping, densely clothed with wooly fibrous scales; stipe stout, 10 to 50 cm. high, brown; frond 30 to 60 cm. high, two-thirds as wide, deltoid tri- to quinquepinnatifid; main rachis slightly winged toward the apex; ultimate segments oblong-deltoid or narrower, themselves usually toothed, inaequilateral; texture coriaceous; venation prominent, irregular, with false veins free at both ends between the true ones; sori several to a segment, marginal but exceeded by the teeth; indusium half-cupshaped.

Luzon, *Cuming* 77; Benguet, *Elmer* 6385; Gimogon River, Negros, *Copeland* 69; Capiz, Panay, *Copeland*.

Madagascar across Polynesia.

Very variable in size and the degree of dissection of the frond. Epiphytic and terrestrial.

D. elata Sw. is a larger and less coriaceous form of this species, with finer divisions.

(6) **D. solida** Swartz. Rhizome stout, densely clothed with adpressed scales or fibers; stipe 10 to 15 cm. high, strong, erect; frond 30 to 60 cm. long, deltoid, tripinnatifid; apex with a moderately broad undivided center; segments ovate-rhomboidal, deeply toothed, narrower and sharper

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in fertile frond; veins uniform; texture coriaceous; sori nearly or quite marginal; involucre semicylindrical.

Cagayan-Luzon, *Warburg* 12203; Mount Mariveles, *Merrill* 3715.

Malaya and Polynesia.

D. solida var. **caudata** Cav. (as species); pinnules more divided with narrower segments.

Baguio, *Topping* 272, *Elmer* 6005.

(7) **D. bullata** Wallich. Rhizome creeping, stout, densely clothed with light-brown or whitish fibrillose scales; stipe about 10 cm. high, erect, strong; frond 15 to 20 cm. long, almost as broad, deltoid, tri-quadripinnatifid; pinnules of the lower pinnæ lanceolate, 5 to 8 cm. long, with deeply inciso-pinnatifid oblong-rhomboidal segments; texture coriaceous; sori deeply half-goblet shaped, occupying the greater part of the tooth in which they are placed, marginal, with usually a horn on the outside.

Benguet, *Loher*, *Elmer* 6490—epiphytic on Pinus, fronds purplish.

India to Korea and Celebes.

(8) **D. decurrens** Hooker. Rhizome stout, creeping, densely fibrillose; stipe 10 to 15 cm. high, stout, erect; frond 30 to 60 cm. long, deltoid, tripinnatifid; main rachis hardly at all winged at the apex; pinnules of the lower pinnæ lanceolate-acuminate, 10 cm. long, 2 to 3 cm. broad, cut down throughout within a short distance of the rachis, with broadly-toothed linear-oblong segments; texture subcoriaceous; veins uniform; sori falling short of the margin; involucre half-cupshaped.

Philippines.

Resembles *D. divaricata* in the shape and position of the sori, but the frond less divided.

(9) **D. divaricata** Bl. Rhizome creeping, stout, clothed with linear ferruginous scales; stipe 15 to 30 cm. high, firm, erect; frond 60 to 90 cm. long, tripinnatifid; lower pinnæ often 30 cm. long by 15 cm. broad; segments deltoid, cut down to the rachis in the lower part, with linear-oblong, sharply toothed lobes; texture coriaceous; veins uniform, not conspicuous; sori half-cupshaped, placed obliquely as regards the central veins in the teeth at some distance from the edge.

Montalban, *Loher;* Davao, *Warburg* 14137.

India to Hongkong and Java.

Best distinguished from *D. solida* and *D. elegans* by the position of the sori.

(10) **D. wagneriana** Copeland. Rhizome stout, scandent, densely clothed with lanceolate, acuminate, appressed brown scales; stipe stout, scaly near the base, glabrous above, as is the thick, slightly winged rachis; frond 20 to 25 cm. high, 10 to 15 cm. broad, glabrous, coriaceous, tripinnatifid at the base only, the fertile narrower than the sterile; the lowest pinnæ not larger than the succeeding, with a few distinct, deeply toothed equal pinnules at the base of each, followed by broadly linear, acutely toothed segments; sori usually a little deeper than broad, only rarely reaching the margin.

Todaya, Davao, 1,100 m., *Copeland* 1300; epiphytic in the crown of high trees.

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(17) MICROLEPIA Presl.

Rhizome creeping, hairy, stipes not articulate to it (exc. *M. ciliata*); sori near the margin; indusium usually as broad as long, fastened at the base and sides. Terrestrial and epiphytic ferns of various aspect. As construed here, the genus includes *Wibelia* Bernh. (*M. pinnata* and its varieties).

1. *Davallodes;* fronds seriate, stipes jointed to rhizome..... (1) *M. ciliata*
1. *Wibelia;* fronds clustered, tracheides present in specialized receptacles of sorus ..... (2) *M. pinnata*
1. *Eumicrolepia;* no tracheides in receptacle, fronds seriate, not jointed to rhizome.
   2. Indusium as long as broad, or longer.
      3. Pinnules bluntly toothed ..... (3) *M. strigosa*
      3. Pinnules of lower pinnæ incised nearly to rachis ..... (4) *M. rhomboidea*
   2. Indusium broader than long.
      3. Frond glabrous.
         4. Small, pinnules crenately lobed ..... (5) *M. philippinensis*
         4. Large, pinnules cut nearly to rachis..... (6) *M. platyphylla*
      3. Frond not glabrous ..... (7) *M. Speluncæ*

(1) **M. ciliata** (Hk.). Rhizome creeping, covered with soft, brown hairs; stipe 10 cm. high, firm, erect, pubescent; frond 30 to 45 cm. long, half as broad, ovate-lanceolate, tripinnatifid; pinnæ spreading, lanceolate, the central ones the largest, 10 cm. or more long, 2 to 4 cm. broad, cut down to a broadly winged rachis, with oblong pinnules cut about half way down with falcate, mucronate teeth; texture thinly herbaceous, flaccid; rachises and under surface softly hairy; sori 2 to 12 to a pinnule, very small, placed near the center of the teeth near the base.

Luzon, *Cuming* 174; Arayat 800 m., *Loher*. Todaya, Davao, 1,100 m., *Copeland* 1273.

(2) **M. pinnata** Cav. Rhizome creeping, fibrillose; stipe nigrescent and squamulose toward the base, strong, erect, 15 to 25 cm. long; frond 20 to 40 cm. long, 10 to 20 cm. wide, with distant linear slightly toothed pinnæ 10 to 15 cm. long, 6 to 8 cm. broad; texture coriaceous; sori one to each tooth, small submarginal.

"Philippines," *Née, Meyen;* Luzon, *Cuming* 139; Mount Mariveles, *Loher, Warburg* 14183.

Malaya and Polynesia.

Warburg's Davao plant is described as epiphytic. The Mariveles specimens are terrestrial, with rhizomes so short the fronds are clustered.

M. pinnata Cav. var. **gracilis** (Bl.) (*Davallia Luzonica* Hk.) Lower pinnæ tripinnatifid, deltoid: sometimes bipinnate throughout. Intermediate forms occur.

Davao, *Loher, Warburg* 14137; Mount Mariveles, *Merrill*, 3213; *Copeland.*

(3) **M. strigosa** (Sw.) Presl. Rhizome stout, creeping, pubescent; stipe erect, strong, 15 to 30 cm. high, both it and the rachis pubescent throughout; frond 30 to 100 cm. long, 15 to 30 cm. broad, lanceolate, bipinnatifid; lower pinnæ 10 to 20 cm. long, 2 cm. broad, linear-lanceolate, much acuminate, cut down to the rachis with unequal-sided, broadly and

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rather bluntly toothed, oblong, rhomboidal pinnules; texture subcoriaceous; veins beneath prominently raised and, like the rachises, more or less hairy; sori 2 to 12 to a pinnule, small, placed at the base of the sinuses.

Luzon, *Cuming* 95; Tonglon, 2,250 m., *Loher* 46.

India to Hawaii and Fiji.

(4) **M. rhomboidea** (Wall.) Presl. Different from *M. strigosa*, of which it is placed as a variety in Synopsis Filicum, in being larger throughout, the lower pinnules lanceolate-deltoid, 4 cm. long, cut down nearly to the rachis into oblong lobes.

Baguio, *Loher*.

India.

(5) **M. philippinensis** Harrington, Journ. Linn. Soc. **16**:27 (1878). Caudex clothed thickly with narrow rufous scales; stipe about 15 cm. high, dark brown, with a few scales below like those of the caudex, glabrous above; frond deltoid, 8 to 20 cm. long, with about the same width; rachis glabrous; lower pinnæ deltoid and again pinnate, the upper becoming simple, at the apex confluent; pinnules linear, crenately lobed, with the divisions extending halfway to the midrib; the first pinnules on the lower side much larger than the others; texture coriaceous; surface glabrous; venules immersed, ascending; involucre decidedly intramarginal, broader than deep. (Near *D. amboynensis* Baker.)

Mount Majayjay, Luzon, *Steere*.

(6) **M. platyphylla** (Don.) J. Sm. Rhizome creeping, stout, scaly; stipe 60 to 100 cm. high, firm, erect; frond 1 m. long, tripinnatifid; lower pinnæ 30 to 40 long, 15 to 25 cm. broad, with distant linear lanceolate pinnules, which are cut nearly to the rachis below into broad, bluntish, toothed, oblong-deltoid lobes; texture subcoriaceous, both surfaces naked; sori 2 to 12 to a segment, placed one in each tooth a short distance from the edge, about 2 mm. across.

Baguio, *Loher* 43.

Ceylon to the Himalayas.

(7) **M. Speluncae** (L.) Moore. Rhizome horizontal; stipe strong, 3 to 10 dm. high, stramineous, minutely squamulose; frond 1 to 2 m. high, half as broad, deltoid, usually quadripinnatifid; lower pinnæ ovate-lanceolate; pinnules lanceolate, cut down to a winged rachis into toothed or pinnatifid lobes, the lowest lobe on the upper side the largest; texture herbaceous; rachis and pinnules hairy, and indusia ornately so; veins conspicuous; sori at the base of the teeth.

Benguet, *Loher*, *Elmer* 6431; Province of Isabela, *Warburg* 11625; Montalban, *Warburg* 12753; Tanay, Rizal, *Ramos;* Sampaloc, Tayabas, *Warburg* 12763; Malita, Davao, *Copeland* 665; Culion, *Merrill* 485.

Around the Tropics.

(18) ODONTOSORIA Presl.

Rhizome short; stipes therefore clustered, not articulate to the rhizome; fronds at least bipinnate; ultimate divisions (in our species) cuneate; sori terminal, at or very near the truncate apex of the segment; indusium fixed by the base and sides. Two confused species. Normally terrestrial.

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(1) **O. chinensis** (L.) J. Sm. (*Lindsaya tenuifolia* (Sw.) Christ.) Rhizome stout, creeping, densely fibrillose; stipe stout, erect, polished, naked, dark brown, 15 to 30 cm. high; frond 30 to 45 cm. long, half as broad, ovate, quadripinnatifid; lower pinnæ ovate-lanceolate, 10 to 15 cm. long, half as broad; pinnules lanceolate, their segments cut down to the rachis below with toothed cuneate lobes, texture subcoriaceous, both surfaces naked, the upper shining; sori terminal, usually solitary, often rather broader than deep.

Tonglon, 1,500 m., and Filad, 1,200 m., *Loher* 61; Sampaloc, Tayabas, *Warburg* 12762, Nueva Ecija, *Merrill* 203.

Madagascar to Japan and Polynesia.

(2) **O. retusa** (Cav.) J. Sm. Stipes strong, erect, not prickly or climbing; frond tripinnatifid; lower pinnæ 30 to 40 cm. long, 15 to 20 cm. broad; pinnules lanceolate-deltoid, the lower segments the same shape, 5 cm. long, 2 cm. broad, cut down to the rachis below, cunneate; texture herbaceous; sori narrow, marginal, occupying the whole breadth of the lobes.

Sampaloc, Tayabas, *Warburg* 12761; Limutan, Morong, *Loher* 62; southern Luzon, *Baranda* 15; Benguet, *Elmer* 5917, 6004, *Topping* 334, 289; Davao, *Copeland* 970 and 1260.

To New Caledonia.

(19) DENNSTAEDTIA Bernhardi.

Rhizome hairy, the stipes not articulate to it; fronds at least bipinnate; sori marginal; indusium united with the margin of the frond to form a sharply differentiated globose receptacle. Rather large ferns, superficially resembling *Dicksonia*, and formerly included under it.

1. Rachises not prickly.
   2. Sori at bottom of sinuses.
      3. Lower surface tomentose-glandular ..... (1) *D. Smithii*
      3. Frond glabrous ..... (2) *D. cuneata*
   2. Sori on ends of teeth.
      3. Rhizome creeping, frond tripinnatifid ..... (3) *D. scabra*
1. Rachises prickly, rhizome scandent ..... (4) *D. scandens*

(1) **D. Smithii** (Hk.) Christ. Frond tripinnate; lower pinnæ 3 dm. long, 1 dm. broad; pinnules linear-acuminate, their divisions distinct, rather distant, narrow, acute, the lower ones 12 mm. long, 4 mm. broad, slightly inciso-pinnatifid; rachises and under surfaces densely tomentose-glandular; texture subcoriaceous; sori 2 to 8 to a segment; receptacle subglobose, cupshaped, 0.5 mm. across.

Luzon, *Cuming;* Rizal, *Loher;* Davao, *Warburg* 14134. *DeVore* and *Hoover* 333, from Davao, is probably this species, but has the segments of the pinules obtuse.

Java, Formosa.

(2) **D. cuneata** (Hk.) Christ. Frond ample, subdeltoid, quadripinnatifid; rachises stramineous, naked; pinnæ lanceolate, 15 to 30 cm. long; pinnules close, short-stalked, lanceolate, 1 cm. broad; segments oblong-rhomboid, 2 to 4 mm. broad, inciso-pinnatifid, cuneate at base, sessile, more cut away on lower side; texture moderately firm; both sides green,

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glabrous; veins subflabellate; sori at base of ultimate sinuses; receptacle cup-shaped, glabrous.

Luzon, *Cuming* 231; Mount Arayat, *Loher*.

Batjan.

(3) **D. scabra** (Wall.) Moore. Rhizome wide-creeping; stipe 30 cm. high, scabrous; frond 25 to 80 cm. high, deltoid or lanceolate, bipinnate; pinnæ lanceolate; pinnules quite distinct, the lower ones cut down nearly to the rachis into numerous pinnatifid oblong deltoid segments, herbaceous or subcoriaceous; rachis and both surfaces more or less hairy; sori 2 to 6 to the lower segments; receptacles cup-shaped, subglobose.

Baguio, *Loher*.

India to Celebes and Japan.

(4) **D. scandens** (Bl.) Moore. Rhizome scandent; fronds sometimes several meters long, growing indefinitely at the apex, climbing by means of their prickly rachises, tripinnate, with the segments bearing broad teeth, flaccid; sori small, placed in the sinuses.

Davao, *Warburg* 14160.

Malaya and Polynesia.

(20) MONACHOSORUM Kuntze.

Rhizome short; stipes therefore clustered, not articulate to the rhizome; frond large, finely dissected; sori a little below the tips of the veins, indusium wanting. The Philippine species is a fairly large terrestrial fern, of very doubtful affinity.

(1) **M. subdigitatum** (Bl.) Kuhn. Stipes tufted, firm, 20 to 50 cm. high, stramineous, glabrescent; frond 45 to 60 cm. high, hardly as broad, quadripinnate; pinnæ horizontal, the lowest 20 to 30 cm. long, 10 to 15 cm. broad; pinnules lanceolate, their segments cut down in turn to their rachis into divisions which in the lowest part of the frond are deeply bifid, pellucido-herbaceous, dark green, turning back in drying, glabrous; vein one in each ultimate segment, not reaching the margin; each vein bearing one sorus below its apex.

Davao, *Warburg* 14178, *DeVore* and *Hoover* 323, *Copeland* 1032, 1143.

India, Malaya.

(21) SCHIZOLOMA Gaudichaud.

Fronds in the Philippine species tufted, pinnate; pinnæ not dimidiate; veins free; sori forming a continuous submarginal line, protected by the more or less inflexed margin and the continuous extrorse indusium. Our first species, not hitherto known from the Philippines, has the aspect of an *Asplenium*, and in its fructification is strikingly like *Vittaria*, to which genus it was first referred; its nearest relatives are probably in *Lindsaya*.

(1) **S. divergens** (Wall.) Diels. Stipes erect, about 10 cm. high, black, polished; frond 15 to 30 cm. high, 3 to 4 cm. broad; pinnæ close, horizontal, except the lower ones which are strongly deflexed and much reduced, lanceolate, obtuse, entire, obliquely truncate on the lower side

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and obtusely auricled on the upper at the base, subcoriaceous, glabrous; veins inconspicuous, forked, costa wavy; sorus slightly interrupted, or continuous around both sides and the apex.

E-wi-ig River, Paragua, *Merrill* 769.

Malaya.

(2) **S. heterophyllum** (Dry.) J. Sm. Rhizome short, creeping, clothed with fine, brown scales; stipes clustered erect, 5 to 15 cm. high, naked, green above; frond 10 to 20 cm. high, pinnate and lanceolate or bipinnate and deltoid; pinnæ semiorbicular and fixed by the middle of the straight side with radiate venation and continuous submarginal indusium around the upper side, or triangular with indusium along two sides, or trapezoidal with usually continuous indusium along upper and outer sides, outer acropetal angle rounded or acute, margin entire or finely toothed, papyraceous, glabrous; veins free except in sorus, or anastomosing more freely. An exceedingly variable fern, some of whose forms are hardly distinguishable from *Lindsaya*.

Luzon, *Cuming* 275; Mount Mariveles, *Copeland* 1375, *Whitford* 1162, *Topping* 351.

Mauritius to Honkong and Malaya.

(22) LINDSAYA Dryander.

Rhizome short or creeping, stipes not articulate to it; fronds at least pinnate; the lower half of each pinna (or pinnule) almost or quite undeveloped, the "midrib" therefore running along the entire lower margin; sori along or near the upper margin; indusia fixed by the base. Small ferns, terrestrial or epiphytic, superficially resembling *Adiantum*.

1. Veins free.
  2. Fronds once pinnate.
    3. Upper edge of pinnæ entire or lobed less than half way to costa.
      4. Rhizome stout and scandent.
        5. Simple sori about as deep as broad.
          6. Upper margin, of pinna entire or lobed ..... (1) *L. repens*
          6. Pinna cleft nearly to rachis .... (2) *L. hymenophylloides*
        5. Sori narrow.
          6. In an unbroken line ..... (3) *L. scandens*
          6. In a broken marginal line ..... (4) *L. pectinata*
          6. Submarginal in the lobes.. (5) *L. Merrillii*
      4. Rhizome not stout and scandent.
        5. Pinnæ less than 1 cm. long.
          6. Frond very narrowly linear ..... (6) *L. gracillima*
          6. Frond not narrowly linear.
            7. Stipe flexuous, pinnæ somewhat auricled ..... (7) *L. ovata*

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7. Pinnæ not auricled.
8. Lamina very thin ..... (8) *L. concinna*
8. Lamina subcoriaceous .. (9) *L. montana*
5. Larger pinnæ more than 1 cm. long.
6. Upper edge of pinnæ very shallowly lobed ..... (10) *L. cultrata*
6. Lobed one-third of way to costa ..... (11) *L. adiantoides*
3. Pinnæ deeply bifid ..... (12) *L. loheriana*
3. Pinnæ repeatedly cleft to the costa.
4. Rhizome stout ..... (2) *L. hymenophylloides*
4. Rhizome filiform ..... (13) *L. capillacea*
2. Fronds when fully developed bipinnate.
3. Upper edge of pinnules entire, pinnules deep ..... (14) *L. Lancea*
3. Shallowly lobed ..... (15) *L. rigida*
3. Cleft nearly to the winged costa..... (16) *L. triquetra*
3. Cleft to the filiform costa..... (17) *L. blumeana*
(Diels puts the preceding two species in the next section.)
1. Veins anastomosing; *Synaphlebium.*
2. Anastomoses well below the sori.
3. Pinnæ dimidiate at base only ..... (18) *L. Sarasinorum*
3. Dimidiate throughout.
4. Lobed one-third of depth ..... (19) *L. davallioides*
4. Almost entire ..... (20) *L. lobata*
2. Anastomoses in the sori only.
3. Rhizome stout ..... (21) *L. apoensis*
3. Rhizome filiform ..... (22) *L. pulchella*

(1) **L. repens** (Desv.) Christ (*Davallia* Desv., H. and B.). Rhizome wide-creeping, paleaceous, climbing; frond simply pinnate, 20 to 45 cm. long, 2 to 4 cm. wide; pinnæ 1 cm. long, about half as broad as deep, the lower line slightly curved, oblique at base, the upper rounded, nearly entire or crenately lobed; texture pellucido-herbaceous; sori marginal, large, about as broad as deep, often confluent in the not crenate form.

Luzon, *Haenke, Cuming* 50; Mount Mariveles, 1,400 m., *Loher* 59; Davao, *Warburg* 14109 and 14182.

India and Mauritius across Polynesia.

Very variable in size.

(2) **L. hymenophylloides** Blume. Rhizome scandent, 1 to 1.5 mm. thick, paleaceous; frond sessile, simply pinnate, larger ones 20 cm. long, 2.5 cm. wide; pinnæ 15 mm. long, 6 mm. deep, cut down to a winged costa into linear-cuneate, entire or forked segments, each bearing 1, or rarely 2, roundish sori; texture membranaceous, entire frond glabrous.

Mount Mariveles, *Merrill* 3220, *Copeland* 229, at 1,200 m. altitude.

Java and New Caledonia.

Regarded by Hooker and Baker as probably a variety of *L. repens.* Put by Diels into § *Synaphlebium;* but our material has free veins.

(3) **L. scandens** Hooker, Sp. Fil. I p. 205 *t. 63 B.* Rhizome stout, wide-creeping, scandent, paleaceous; frond 20 to 30 cm. long, 4 cm. broad,

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simply pinnate; pinnæ 2 cm. long, 12 mm. broad, the lower line slightly decurved, the upper rounded, entire, the point broadly rounded, placed in a long row close together, but not imbricate; texture pellucido-herbaceous; costa marginal; sori in a continuous marginal line.

Philippines, *Cuming;* Mount Dagatpan, Davao, *Warburg* 14142.

Malay Peninsula.

Said to be sometimes bipinnate, but very doubtfully distinct from *L. pectinata.* The two characterized by the stout scandent rhizome.

(4) **L. pectinata** Blume. Rhizome stout, scandent, paleaceous; stipe erect, very short; lower fronds 50 cm. long, 3 cm. broad, simply pinnate; pinnæ 15 mm. long, 6 mm. deep, the lower line nearly straight, the upper margin round, slightly crenate, the point blunt, close together but not imbricate; texture pellucido-herbaceous; sori in an interrupted line along the upper edge.

Luzon, *Cuming* 186; Maquiling, *Loher* 60; Gimogon River, Negros, *Copeland* 53.

Assam and Malay region.

Habit of *L.* (*Odontoloma*) *repens.* Beside the typical fronds, old rhizomes produce finely dissected, much smaller sterile ones, resembling those of *Asplenium epiphyticum* and *Stenochlaena* (*Teratophyllum*), or the fertile fronds of *L. capillacea.*

(5) **L. Merrillii** Copeland. Rhizome stout, scandent, shining, sparsely clothed with spreading ferruginous paleæ; stipe 2 to 5 cm. high, stout, slightly scaly, at the top, straw-color, like the rachis; frond about 80 cm. long, 4 cm. wide, pinnate; lower pinnæ stalked, the larger ones 22 mm. wide by 9 mm. deep next the rachis, dimidiate, the base strongly drawn down, making the pinnæ deepest there, apex usually acute, lower margin entire, upper inciso-crenate; glabrous, membranaceous; veins free; sori wider than deep, the acute tips of the lobes projecting over them.

Baco River, Mindoro, *Merrill* 1774, on tree trunks in moist forest; Sablan, Benguet, *Elmer* 6124.

(6) **L. gracillima** Copeland. Rhizome short; stipes densely tufted, erect brown, almost smooth, 5 cm. high; frond narrowly linear, about 320 by 9 mm., pinnate, glabrous; pinnæ stalked, triangular or rhomboidal, 4 mm. wide, 3 mm. deep, lower margin straight, upper rounded, entire, or when sterile crenate, the lowest pinnæ minute; texture herbaceous; veins free, flabellate; sori marginal, more often continuous.

Caraballo Sur, Luzon, *Merrill* 287, on shady ground, altitude, 800 m.

(7) **L. ovata** J. Sm. Rhizome short-creeping; stipe 5 to 8 cm. high, wiry, flexuose, black; frond 10 to 15 cm. long, 2 cm. broad, simply pinnate; pinnæ 8 mm. long, 4 mm. deep, not imbricate, the lower ones with their own breadth between them, horizontally oblong, the point very blunt, the lower side obliquely truncate at the base, the upper slightly auricled; texture subcoriaceous; sori in a continuous marginal line.

Luzon, *Cuming* 175.

(8) **L. concinna** J. Sm. Rhizome short-creeping; stipe 1.5 to 7 cm. long, wiry, erect; frond 10 to 30 cm. long, 12 to 17 mm. broad, simply pinnate; larger pinnæ 7 mm. long, 4 mm. deep, very blunt on the outer

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edge, the upper edge very slightly crenate, the upper ones close together, but scarcely imbricate; texture pellucido-herbaceous; sori in a continuous or slightly interrupted line along the upper edge.

Luzon, *Cuming* 198; Tonglon, *Loher* 51; Gubat, *Baranda* 18, Lamao River, Bataan Province, *Merrill* 3779, *Copeland* 271, 231, 228 (with remote pinnæ), Gimogon River, Negros, *Copeland* 67, 52 (pinnæ imbricate).

Borneo.

Baker says this is merely a variety of *L. cultrata.*

(9) **L. montana** Copeland. Rhizome very short-creeping; ferruginous-scaly; stipes 1 to 3 cm. high, tufted, slender, flexuous, red brown below, upward becoming straw color and almost glabrous, like the rachis; frond 3 to 6 cm. high, 1.5 cm. broad, pinnate; pinnæ stalked, 9 mm. broad, 6 mm. deep, the lower ones very deflexed, their lower margin reflex-arcuate, upper margin round, entire or incised, general shape semiorbicular, upper pinnæ smaller, ascendent, with acute bases; texture coriaceo-membranaceous; veins free, flabellate; sori submarginal, usually continuous.

Mount Mariveles, altitude, 1,100 m., *Copeland* 230, terrestrial.

Different from *L. concinna* in the much shorter fronds, and deflexed, firmer, and much deeper pinnæ.

(10) **L. cultrata** Swartz, Syn. 119. Rhizome short-creeping; stipe 3 to 6 cm. long, wiry, flexuose, rich brown; frond about 20 cm. long, about 2 cm. broad, simply pinnate; largest pinnæ 12 mm. long, 6 mm. deep, not imbricate, the lower margin straight or slightly curved, usually upwards, the upper edge slightly lobed, so that the continuity of the line of the fructification is broken, sometimes nearly entire, pinnæ stalked; texture coriaceo-membranaceous.

Luzon, *Cuming* 65, 243; Davao, *Loher* 50; *Copeland* 1268; Hinay-Gate, *Baranda* 19; Benguet, *Topping* 197, 308.

Madagascar and Himalayas to Queensland and perhaps Japan.

L. cultrata Sw. var. **varia** Copeland. Differs from the type in the much shorter frond and stipe, membranous texture, and very variable form of the pinnæ.

Baguio, on rocks along streams, apparently common, *Elmer* 6003, *Topping* 191, 198.

(11) **L. adiantoides** J. Sm. (*L. humilis* Kuhn). Stipes nearly tufted, black, polished, wiry, 2 to 5 cm. high; frond 10 to 15 cm. long, about 2 cm. broad, simply pinnate; pinnæ 1 cm. long, 6 mm. deep, the upper imbricate, the lower edge straight or slightly curved, the upper rounded and broadly lobed about one-third of the way down; texture pellucido-herbaceous; sori marginal in the lobes.

Camarines Sur, *Cuming* 176; southern Luzon, *Baranda* 17.

Java.

(12) **L. loheriana** Christ, Bull. Herb. Bois. 6(1898):144. Rhizome short-creeping, firm; stipes 2 cm. long, fasciculate, terete, slender but firm and erect, base purple; frond 12 cm. long, 1 cm. wide, lanceolate-acuminate, simply pinnate; pinnæ alternate on 2 mm. long petioles, 5 mm. long, triangular-cuneate, lower edge entire, upper deeply bifid; lobes broadly cuneate, with evident, forked, free veins; sori terminal, single

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or double, the width of the lobe; indusium inflated; texture moderately firm; color yellowish, stipe stramineous.

Baguio, *Loher* 56.

Habit of a small and simple form of *L. viridis* Col.

(13) **L. capillacea** Christ, Bull. Herb. Bois. **6**(1898):144. Rhizome filiform, creeping and intertwined; stipe 15 mm. long, filiform, fuscescent, rachis green; frond 1 dm. long, 1 cm. wide, linear-lanceolate, acuminate, weak, flaccid, subbipinnate; pinnæ alternate, 5 mm. long, oblong-triangular, lower edge entire with costa close to it, upper edge incised almost or quite to the costa into 3 or 4 erect segments which are linear, narrowed upward, the lower segments forked; sori small, terminating the segments, flanked on each side by acute teeth.

Maquiling, 600 to 1,000 m.; *Loher* 57; Baguio, *Elmer* 6020.

The dissected sterile fronds adventive on old rhizomes of *L. pectinata* resemble this plant.

(14) **L. Lancea** (L.) Christ (*L. trapeziformis* Dry.). Rhizome short-creeping; stipe strong, erect, 14 cm. long, green except at base; frond 10 to 20 cm. long, with a long entire point and 1 to 4 pairs of rather rigidly erecto-patent branches, pinnæ (pinnules) about 2.5 cm. long, 1 cm. deep, the lower line nearly straight or curved downwards, the upper rounded, entire, closely placed, but scarcely imbricate; texture pellucido-herbaceous; sori in a continuous line below the upper margin.

Negros, Gimogon River, *Copeland* 66; Davao, *Loher* 52.

Tropical America, Ceylon, Malay region.

(15) **L. rigida** J. Sm. Rhizome wide-creeping; stipe 10 to 15 cm. high, rigid, erect, prickly towards the base; frond with a long unbranched central point and 1 to 4 pairs of flexuose lateral branches, 10 to 20 cm. long; pinnules 6 to 8 mm. broad, 4 mm. deep, the lower edge often falcate, the upper three or four times bluntly, not deeply lobed, placed close together but not imbricated; texture very thick and coriaceous; veins prominent; sori in a marginal line on the lobes.

Davao, *Loher* 55; Luzon, *Baranda* 20.

Malay Peninsula.

The color of the mature frond is sepia brown, and the pale veins stand out from the groundwork in relief.

(16) **L. triquetra** (Baker) Christ (*L. tenuifolia* Bl.). Rhizome creeping, fibrillose; stipe strong, erect, 10 to 15 cm. high; frond with 2 to 7 pairs of pinnæ and a terminal one; lateral pinnæ spreading, with subrigid rachises, 10 cm. long, 1 to 2 cm. broad; pinnules cut down on the upper side into narrow simple or forked linear segments well toward the nearly straight costa; texture pellucido-herbaceous, both surfaces naked; sori small, terminal on the segments; indusium suborbicular.

Leyte, *Cuming* 309; Davao, *Loher* 58.

Java to Samoa.

(17) **L. blumeana** (Hk.). Rhizome creeping; stipe 10 to 15 cm. high, strong, erect; frond 20 to 30 cm. long, 15 to 20 cm. broad, bipinnate; pinnæ rigid, erecto-patent, 10 to 15 cm. long, 1 cm. broad; pinnules thinly herbaceous, cut down on the upper side into very slender filiform simple

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or forked segments to a recurved filiform rachis; sori small, nearly terminal on the dilated apices of the segments; involucre suborbicular. Epiphytic.

Leyte, *Cuming* 309.

Celebes, Java.

(18) **L. Sarasinorum** Christ, Ann. Bot. Buitenzorg. 15:101. Rhizome short-creeping; stipe 12 cm. high, reddish brown, clustered, brown-squamulose, as is the rachis; the rest of the plant glabrous, herbaceous in texture; frond 8 to 12 cm. long, simply pinnate or tripartite; pinnæ (pinnules) halved at the base, becoming equilateral toward the apex; narrowly oval or rhomboidal, up to 3 cm. long, strongly bent outward, on the outside lobed into 4 or 5 lobes, which are often forked, broad, obtuse, with a thick, brown, apical sorus; veins freely anastomosing near the base, free toward the margin.

Maquiling, *Loher*.

Celebes.

Differs from *L. davallioides* in that the pinnæ are longer, narrower, arcuate-deflexed, and not dimidiate at the apex, and the lobes broader, deeper, and often forked.

(19) **L. davallioides** Blume. Rhizome short-creeping; stipe 6 to 12 cm. high, firm, erect; frond with a long central point and one to three pairs of spreading curved branches, 4 to 8 cm. long; pinnæ 1 cm. long, 5 mm. broad, the lower margin straight or slightly curved, the upper with 3 to 6 regular truncate lobes one-third the depth of the pinnæ, placed close together but not imbricated; texture pellucido-herbaceous; veins anastomosing below the base of the lobes; sori marginal in the lobes.

Castillo, 800 m., *Loher* 53; Daet and Gubat, *Baranda* 16; Mount Mariveles, *Copeland* 1380.

Malay region.

(20) **L. lobata** Poir. Rhizome short-creeping; stipe 10 to 20 cm. high, firm, erect; frond simply pinnate or with a long unbranched apex, and 1 to 6 pairs of erecto-patent branches, 7 to 20 cm. long; pinnules 10 to 13 cm. long, half as broad, the lower decurved principally at the base, the outer margin rounded, the upper entire or incised enough to interrupt the sorus, close-placed, but not imbricated; texture thinly pellucido-herbaceous; veins anastomosing; sori marginal.

Luzon, *Steere;* Paragua, *Merrill* 713.

India to Polynesia and Queensland.

Much resembling *L. davallioides* in general appearance, but the pinnules are deeper and not so much lobed.

(21) **L. apoensis** Copeland. Rhizome 1 mm. thick, scandent, ferruginous, almost glabrous; stipes 12 to 18 cm. high, straight or flexuous, stout, the bottom rich brown, upward green and nearly glabrous, as is the rachis; frond about 20 cm. high, 6 cm. broad, pinnate; pinnæ short-stalked, glabrous, herbaceous, the larger ones 40 by 7 mm., the lower margin arcuate, the upper incised into usually linear lobes, more deeply toward the end of the pinna; veins free except sometimes in the sori; sori small, roundish, just below the tip of the lobe.

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Mount Apo, Mindanao, altitude 1,600 m., *Copeland* 1181, *DeVore* and *Hoover* 365.

(22) **L. pulchella** (Hk.) (*Davallia* § *Odontoloma* Hooker). Rhizome slender, wide creeping, and much branched; stipe slender, wiry, erect, naked, reddish brown below, 2 to 4 cm. long; frond 15 to 25 cm. long, 10 to 17 mm. broad; pinnæ slightly stalked, larger ones 8 mm. across, 5 mm. deep, the lower or all more or less curved upward, oblique at the base, the upper cut into 2 to 3 blunt lobes or entire; texture membranaceous, rachis and both surfaces naked; sori small, placed in the lobes at a short distance from the edge; veins sometimes anastomosing at the apex, and then their sori confluent.

"Manila," *Née, Cuming* 217; Davao, *Warburg* 14189, *Copeland* 991 and 1116, altitude, 4,600 and 6,000 feet; Baguio, *Elmer* 6019.

Fiji, Samao.

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IV. ASPLENIEÆ.

Sori superficial (not in grooves), springing from the sides of the fertile veins; indusium opening on the side away from the vein, or wanting; stipe not articulate to the rhizome.

1. Sori born along lateral veins or veinlets, not parallel to the midrib.
    2. Indusium wanting.
        3. Veins free, fronds pinnate ..... (23) *Coniogramme*
        3. Veins anastomosing, fronds simple.
            4. Sori anastomosing copiously..... (24) *Hemionitis*
            4. Sori seldom or never anastomosing.
                5. Veins invisible, anastomosing throughout ..... (25) *Loxogramme*
                5. Veins visible, anastomosies marginal.... (26) *Syngramme*
    2. Indusium present.
        3. Veins forming regular areolæ.
            4. Indusium opening along its margin..... (27) *Callipteris*
            4. Indusium rupturing irregularly ..... (28) *Allantodia*
        3. Veins free (unless at the margin).
            4. Some sori double, on both sides of a vein, the free sides opening ..... (29) *Diplazium*
            4. All sori simple ..... (30) *Asplenium*
            4. Sori between two veins, indusia attached to veins, opening along middle ..... (31) *Triphlebia*

1. Sori parallel to midribs (*Blechneæ*).
    2. Indusium wanting, rhizome scandent..... (32) *Stenochlaena*
    2. Indusium present, mostly terrestrial.
        3. Veins free between sori and margin..... (33) *Blechnum*
        3. Veins anastomosing between sori and margin..... (34) *Woodwardia*

(23) CONIOGRAMME Fée.

Rhizomes creeping; fronds pinnate or bipinnate, glabrous, fertile frond nowise differentiated; veins pinnately arranged, forked, in Philippine material free; sori covering the veins from the midrib to well toward the margin, exindusiate, without paraphyses. Large terrestrial ferns, thin in texture.

(1) **C. fraxinea** (Don) Fée (*Gymnogramme Javanica* Bl.). Stipe 0.3 to 1.2 m. high, naked unless at the base, stramineous or brown, polished; frond about 1 m. high, broadly lanceolate, pinnate or bipinnate; pinnæ (or pinnules) short-stalked, the upper sessile, lanceolate, long-acuminate, entire or serrate, herbaceous; veins mostly once forked; sori along all of them.

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Baguio, *Elmer* 6032; Arayat, *Loher;* Davao, *Copeland* 980, 1135.

Tropical Africa across Malaya to Hawaii.

Two reasonable distinct Philippine ferns are included here, one entire and usually simply pinnate, the other serrate, bipinnate, and more membranous, usually at a higher altitude.

(24) HEMIONITIS Linnaeus.

Rhizome short; stipes clustered, chaffy, those of the sterile frond much the shorter; fronds in the Philippine species entire or lobed, with ample base, pubescent; veins copiously anastomosing, bearing sori throughout. Striking ferns; with a cluster of sterile fronds on the ground, and the single or few fertile ones long stalked.

(1) **H. arifolia** (Burm.) Beddome. Stipes of the sterile fronds 2 to 5 cm. long, of the fertile 20 to 30 cm., brown or black, glossy, chaffy throughout; fronds 5 to 7 cm. long, 3 to 4 cm. broad, entire or nearly so, apex rounded, base deeply cordate, the fertile frond rather the smaller and with more developed basal lobes, coriacous, lower surface chaffy, sparsely unless on the costa and margin; midrib disappearing below the apex, other veins almost invisible; sori forming a fine network over the fruiting surface.

Corregidor, *Cuming* 285; Manila, *Loher;* Antipolo, *Guerrero;* Mount Mariveles, *Merrill* 3259.

India.

The Philippine plant differs from the Indian in having narrower fronds, the sterile shorter stalked, stipes squamulose throughout, and texture more coriaceous.

(2) **H. Zollingeri** Kurz. Fronds clustered in a dense rosette; the sterile nearly sessile, oblanceolate, entire, about 10 cm. long, membranaceous; main veins distinct nearly to margin, with copious fine, irregular areolæ between them; fertile fronds linear, slightly repand, 8 cm. long, less than 1 cm. broad, with a stipe 3 to 5 cm. high; sori in 2 to 3 rows, parallel with costa and margin, anastomosing by short cross-bars.

Panay, *Steere.*

Sumatra to Celebes.

(3) **H. gymnopteroidea** Copeland. Caudex short, erect, scaly at the tip; fronds clustered, the sterile sessile or subsessile, 7 to 17 cm. long, 2.3 to 5 cm. broad, oblanceolate, obtuse or acute, margin repand and crisped, broad or contracted at the base, papyraceo-herbaceous, dark green with light patches, glabrous except for the usually squamulous costa; areolæ rather large, with copious free included veinlets; fertile frond on a stipe 5 to 15 cm. high, itself 5 to 10 cm. high, 2 to 4 mm. broad, the lamina often interrupted; soriferous veins 1 to 3 on each side, about parallel to the costa, occasionally anastomosing; entire lower surface early covered by sporangia.

Lamao Forest Reserve, terrestrial at lower elevations, *Copeland, Merrill* 3113; *Barnes* 166.

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(25) **LOXOGRAMME** Presl.

Fronds somewhat clustered, not articulate to the rhizome, simple and entire, sessile or nearly so; veins immersed, anastomosing irregularly to form large areolæ with few or no included free veinlets, no main veins; sori elongate, forming an acute angle with the costa or even parallel to it, exindusiate.

Loxogramme is combined with *Selliguea* as a part of *Gymnogramme* in Synopsis Filicum, and buried with it by Diels in *Phymatodes*. It differs more than ordinarily generically from *Selliguea* in the venation and the absence of articulations to the rhizome. The type species, *L. lanceolata*, was more reasonably placed by Blume in *Antrophyum*. Placing all these exindusiate genera in the *Asplenieæ* is arbitrary.

(1) **L. involuta** (Don.) Presl. Rhizome short-creeping, stout, clothed with dull brown, lanceolate, acuminate scales; frond 30 to 45 cm. high, 5 to 6 cm. broad, subacute, somewhat repand and inclined to roll upward, gradually attenuate to the base, very leathery, glabrous; costa stout and prominent, veins invisible; sori oblique, almost reaching the costa and margin.

Rizal, *Merrill* 2663; Davao, *Warburg* 14116, *Copeland* 961.

India to Polynesia.

(2) **L. lanceolata** (Blume) Presl. Rhizome creeping, clothed with dull brown linear scales; frond 15 to 30 cm. high, 1 to 2 cm. broad, acute, entire, narrowed uniformly from well above the middle to the sessile base, coriaceous but flaccid, glabrous, bright green; costa evident but not stout, veins hidden; sori very oblique, falling well short of margin.

Benguet, *Loher, Elmer* 6276; Mount Mariveles, *Copeland* 1406.

Africa to Japan and Polynesia.

(3) **L. parallela** Copeland. Rhizome short-creeping, clothed with ashy brown, lanceolate, acuminate scales; fronds linear, about 15 cm. high, 6 mm. broad, straight or sinuate, acuminate, entire, gradually attenuate to the subsessile base, coriaceous, glabrous; costa conspicuous below, veins invisible, free included veinlets none; sori oblong, in a single series on each side of the costa, near and almost or quite parallel to it.

Mount Santo Tomas, Benguet, *Elmer* 6569.

(4) **L. conferta** Copeland. (*Drymoglossum*, Copeland in Perkins' Fragmenta, Fas. III, 1905.) Rhizome slender, intricate, clothed with small, thin, brown, lanceolate, acuminate scales; fronds short stalked, forming a dense mat, coriaceous, the veins forming a few areolæ without free included veinlets, the sterile frond ecostate, elliptical, 18 mm. long, 13 mm. broad, apex round, base cordate, fertile frond 25 by 3.5 mm., apex round, base attenuate; sori midway between costa and margin, covering the entire lamina when old.

Catalonan, Davao, *Copeland* 942; San Ramon, Zamboanga, *Copeland* 1583. The San Ramon plants are the younger, and show the real affinity to *Loxogramme*. But it is a very foreign element in this genus.

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(26) SYNGRAMME J. Sm.

Rhizome creeping; fronds simple, and entire or merely sinuate, fertile and sterile alike; veins pinnately arranged, simple or forked, anastomosing near the margin only; sori in unbroken straight rows along the veins, naked. Terrestrial ferns, notable for their ample simple fronds.

(1) **S. vittaeformis** J. Sm. Stipes subtufted, not very tall, naked, flexuose, dark brown; frond 20 to 30 cm. tall, 2 to 6 cm. broad, spatulate-oblong, irregularly repand, acute, coriaceous, glabrous; veins fine, parallel, forming one or two rows of distinct areolæ near the edge; sori extending from the midrib to the margin.

Samar, *Cuming* 329.

(2) **S. alismaefolia** (Presl) J. Sm. Rhizome short, clothed with minute chestnut hairs; stipes 20 to 60 cm. high, firm, polished, chestnut-brown; frond 15 to 25 cm. long, 6 to 10 cm. broad, acuminate, entire, with rounded base, coriaceous, glabrous; veins fine, indistinct where they unite, near the margin; sori on all the veins, from the midrib to where they unite.

Luzon, *Haenke;* Gimogon River, Negros, *Copeland* 75.

Singapore.

(3) **S. Wallichii** Hooker (sub *Gymnogram.*). Rhizome creeping underground; stipes subfascicled, 15 to 40 cm. high, ebeneous; fronds subcoriaceous-membranaceous, simple, 15 to 25 cm. long, 3 to 5 cm. broad in the middle, broadly lanceolate or subelliptico-acuminate, entire, cuneate-attenuate at the base; veins numerous, approximate, simple or forked, anastomosing only near the margin, forming rarely more than 2 series of oblong, hexagonal areolæ; sori narrowly linear, on all the straight veins, but hardly extending to the anastomosing ones. Distinguished from *S. alismaefolia* by the longer fronds and the tapering base.

Jolo Archipelago, *Burbidge.*

Singapore and Borneo.

(27) CALLIPTERIS Bory.

Rhizome short, erect; fronds accordingly in clusters, simple, pinnate, or bipinnate; veins from neighboring clusters anastomosing; sori as in *Diplazium*, that on the lowest acropetal branch double, the others single as in *Asplenium*. Terrestrial ferns, mostly with large glabrous fronds.

Callipteris is combined with *Diplazium* by Diels, and both are included in *Asplenium* in Synopsis Filicum. Underwood says twelve species are known from the Philippines. Beside those here described, Presl enumerates *Microstegia ambigua, M. serrulata,* and *Callipteris attenuata.*

1. Simple, or with terminal pinnæ like lateral.
   2. Cordate, lateral pinnæ at most 2 pairs ..... (1) *C. cordifolia*
   2. Not cordate.
      3. Lateral pinnæ at most 3 pairs, veins about 3 together ..... (2) *C. alismaefolia*
      3. Lateral pinnæ at most 6 pairs, veins 4 to 8 together ..... (3) *C. elegans*

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3. Lateral pinnæ more than 6 pairs, veins mostly 2 together ..... (4) *C. pariens*
1. Pinnate with pinnatifid apex ..... (5) *C. prolifera*
1. Twice or more pinnate ..... (6) *C. esculenta*

(1) **C. cordifolia** (Blume) J. Sm. Stipes clustered, 20 cm. long, firm, erect, scaly below; frond 30 cm. long, 10 cm. broad, entire, cordate, acuminate, coriaceous; veins in close groups of about 4, anastomosing copiously in the outer half of the pagina; sori reaching from the midrib to the margin. Less frequently there are one or two pairs of smaller lateral pinnæ (*Diplazium integrifolium* Blume).

Leyte, *Cuming* 307.

Africa to Polynesia.

(2) **C. alismaefolia** J. Sm. Hook. Journ. Bot. 3:409. Stipes 5 to 15 cm. high, firm, erect, scaly throughout; frond varying in shape from simple, oblong-lanceolate, 15 to 25 cm. long, 5 to 8 cm. broad, entire, acuminate, to ternate or pinnate, with a large terminal and three pairs of lateral pinnæ, each like the entire frond of the simple state, coriaceous; veins about three to a group in the inner half, but anastomosing copiously with hexagonal areolæ toward the edge.

Luzon, *Cuming* 116; Davao, *Warburg* 14115 (simple), 14102 (trifoliate), 14177 (pinnate).

Celebes.

Although Presl separates this plant as the genus *Ochlogramme* from the neighboring two, it is too near them for easy specific separation by the descriptions.

(3) **C. elegans** J. Sm. Hooker's Journ. Bot. 3:409. (First described as *Anisogonium elegans* Presl, Epim. Bot. p. 93. *Asplenium lineolatum* Mett. in Syn. Fil.) Stipes 15 to 25 cm. high, firm, erect, gray, scaly below; frond occasionally simple, usually with a terminal pinna and 3 to 6 pairs of lateral ones, which are 15 to 30 cm. long, 5 cm. or more broad, entire, often suddenly acuminate, coriaceous; rachis naked; veins 4 to 8 to a cluster, uniting slightly toward the edge.

Luzon, *Cuming* 276; Leyte, *Cuming* 305 (*A. grossa* Presl).

Malaya.

(4) **C. pariens** Copeland. Caudex black, clothed with lanceolate, dark brown paleæ 8 mm. long; stipe channeled, about 35 cm. high, black and somewhat scaly at the base, like the rachis above, green and clothed with very minute fibrils; pinnæ in the type 11 pairs, those of the lower half of the frond larger, 10 cm. long, 4 cm. broad, ovate, acuminate, base rounded, short stalked, entire, subcoriaceous, glabrous; terminal pinna like the lateral; upper axils bearing bulbils which grow into young plants before falling; veins once or twice forked, anastomosing and indistinct in the marginal third of the blade; sori linear, straight, extending as far as the veins are distinct.

Todaya, Davao, altitude 1,100 m., *Copeland* 1287.

(5) **C. prolifera** Bory (*Asplenium decussatum* Swartz, Syn. Fil.). Stipe 20 to 40 cm. tall, firm, erect, muricate; frond 40 to 120 cm. tall,

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with numerous pinnæ and a large pinnatifid terminal segment; pinnæ 8 to 20 cm. long, 3.5 to 5 cm. broad, entire or serrate or slightly lobed, acuminate, the lower stalked, the upper sessile and sometimes proliferous; veins in pinnate groups, the veinlets from neighboring veins uniting to form a series of arches; sori on all these veinlets, but the veins running from the costa to the margin sterile.

Luzon and Leyte, *Cuming* 303; Baco River, Mindoro, *Merrill* 1776; Davao, *Copeland* 663, 949; San Ramon, Zamboanga, *Copeland* 737.

Africa across Polynesia.

(6) **C. esculenta** (Retz). Caudex sometimes rising above the ground; stipes 30 to 60 cm. high, firm green, almost smooth; fruiting fronds 80 to 150 cm. high, half as wide, bipinnate; pinnules more or less lobed, acute, truncate at base, sometimes auricled, glabrous, herbaceous; veins pinnate running directly from costa to margin, sterile, their branches bearing sori, anastomosing in pairs from neighboring veins forming a series of small arches.

Luzon, *Haenke;* Manila, *Loher; Warburg* 12746; Province of Bataan, *Merrill* 2542, 2552; Carranglang, *Merrill* 280; Benguet, *Topping* 210; Davao, *Copeland* 604.

India to Malaya and Formosa.

The young plants are eaten as greens by natives everywhere, called "Paco."

(28) ALLANTODIA R. Brown (in part).

Veins forming 2 or 3 series of areolæ in the marginal half of the lamina and ending in an intramarginal cross-vein; sori running from near the costa to the first areola; indusium fastened all round its margin, and rupturing irregularly when the spores mature. A single terrestrial fern, apparently related to *Callipteris*.

The first plant described in this genus has since been placed in *Asplenium* § *Athyrium;* but the genus is now universally recognized as defined here.

(1) **A. javanica** (Blume) Beddome. Rhizome short; stipe about 30 cm. high; frond 30 to 60 cm. high, half as broad, pinnate; pinnæ lanceolate, entire or serrulate at the apex, glabrous, membranaceous.

Davao, *Warburg* 14118.

India across Polynesia.

(29) DIPLAZIUM Swartz.

Rhizome creeping, or more often erect; fronds simple to tripinnate; veins free; the lowest acroscopic branch of each vein bearing a double sorus, the other fertile veinlets bearing single sori on the side facing the apex of the vein the veinlet springs from, as in *Asplenium*. Mostly robust terrestrial ferns. Paleæ often harsh and dark; main roots usually stout and black.

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On some species, and on sparsely fruiting fronds of others, the lowest pinnæ are sterile, and the sori present are all of the *Asplenium* type.

1. Simply pinnate.
  2. Pinnæ entire or nearly so.
    3. Pinnæ few.
      4. Terminal pinna like lateral.
        5. Sori reaching margin ..... (1) *D. bantamense*
        5. Sori remote from margin ..... (2) *D. palauanense*
      4. Apex pinnatifid ..... (3) *D. cultratum*
    3. Pinnæ 8 or more pairs.
      4. Veins once or twice forked.
        5. Frond membranous ..... (4) *D. camarinum*
        5. Frond subcoriaceous ..... (5) *D. pallidum*
      4. Veinlets more numerous ..... (6) *D. sylvaticum*
  2. Pinnæ lobed.
    3. Upper half of pinna the more developed.
      4. Stipe and rachis more or less hairy..... (7) *D. grammitoides*
      4. Rachis naked, stipe nearly so ..... (8) *D. japonicum*
    3. Pinnæ equilateral.
      4. Rachis naked unless at base.
        5. Small, pinnæ less than 10-jugate (9) *D. bulbiferum*
        5. Large, pinnæ more than 10-jugate ..... (10) *D. speciosum*
      4. Rachis fibrillose or hairy.
        5. Lower pinnæ sessile ..... (11) *D. sorsogonense*
        5. Lower pinnæ stalked ..... (12) *D. petiolare*
1. Frond barely bipinnate ..... (13) *D. brachypodum*
1. Frond copiously bipinnate.
  2. Pinnules lobed less than half way to costa.
    3. Rachis naked, stipe nearly so ..... (14) *D. cyatheaefolium*
    3. Rachis naked, stipe scaly below ..... (15) *D. latifolium*
    3. Rachis and stipe tomentose ..... (16) *D. vestitum*
  2. Pinnules lobed more than half way to costa.
    3. Fronds less than 50 cm. tall..... (17) *D. deltoideum*
    3. Fronds 1 m. or more tall.
      4. Sori reaching nearly to margin..... (18) *D. meyenianum*
      4. Sori falling well short of edge.
        5. Rachis green ..... (19) *D. polypodioides*
        5. Rachis ebeneous ..... (20) *D. ebenum*

(1) **D. bantamense** Blume. Rhizome short, stout, scaly; stipe 15 to 30 cm. high, scaly at the base, firm, erect, stramineous; frond 20 to 40 cm. high, rarely simple, usually with a large terminal pinna and 1 to 3 pairs of similar but usually smaller lateral ones; pinnæ 1 to 2 dm. long, broadly lanceolate, entire or nearly so, acute or acuminate, narrowed to an almost sessile base, glabrous, coriaceous; veins forked about three times; diplazioid sori extending from the midrib nearly to the margin.

Sablan, *Elmer;* Rizal, *Ramos;* Negros, *Copeland* 60, 80; Balabac Island, *Steere.*

Himalayas, Hongkong, Malaya.

(2) **D. palauanense** Copeland. Stipe firm, 30 to 40 cm. high, black and black-scaly at the base, stramineous or brown above, glabrous; frond 30 to 60 cm. high, pinnate, terminal and lateral pinnæ alike; pinnæ about 6 pairs, alternate, remote, larger ones 30 cm. long, rather narrowly lanceolate,

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acute, obscurely serrate, glabrous, coriaceous, the lower ones short stalked; veins 2 or 3 times forked; sori linear, not reaching the margin.

Palauan, in open woods; altitude, 500 m., *Merrill* 746.

(3) **D. cultratum** Presl Epim. Bot., p. 84. Stipes tufted, 10 to 15 cm. high, gray, naked, or the upper part and the rachis bearing a short hyaline horizontal pubescence; frond 15 to 25 cm. high, half as broad, pinnate with pinnatifid apex; pinnæ 3 to 5 pairs, oblong-ovate, acute, subfalcate, nearly entire, narrowed abruptly at base, and auricled, the lower stalked, coriaceous, glabrous; veins twice forked; sori linear, reaching the edge but not the midrib.

Luzon, *Cuming* 199, *Steere*.

(4) **D. camarinum** Baker. Stipe and rachis dull brown, naked; frond oblong, simply pinnate, 30 to 45 cm. long, 15 to 25 cm. broad; pinnæ 8 to 12 pairs, distant, stalked, linear-ligulate, acute, crenate, 10 to 15 cm. long, 2 cm. broad, rather reduced on lower side, rounded on both sides at base, lowest not reduced, membranous, glabrous, dull green; veins distinct, in close, little ascending pairs, posterior forked, anterior simple; sori reaching from costa to edge, indusium persistent.

South Camarines, *Cuming*.

(5) **D. pallidum** Blume. Stipe 15 to 30 cm. high, firm, erect, naked; frond 30 to 60 cm. long, 15 to 30 cm. broad, with numerous horizontal pinnæ on each side, the lower ones stalked, 4 cm. apart, 8 to 15 cm. long, 2 cm. broad, linear-lanceolate, acuminate, base rounded especially on the upper side, edge often sharply toothed, subcoriaceous; veins once or twice forked; sori in regular lines from the costa very nearly to the edge.

Davao, terrestrial in the forest, *Copeland* 956.

Malaya.

The Davao fern is larger in every way than this description, copied from Synopsis Filicum, states, but otherwise agrees perfectly.

(6) **D. sylvaticum** Swartz Syn. Fil., p. 92. Caudex decumbent or erect, stout, short, bearing crowded stout roots; stipes 10 to 30 cm. high, firm, erect, scaly at the base only; frond 20 to 40 cm. high, half as broad, pinnate with pinnatifid apex; pinnæ numerous but not crowded, acute, broadly but shallowly lobed and lobes entire or obscurely toothed, rather abruptly narrowed at the base, mostly stalked, glabrous, subcoriaceous, pale beneath; veins pinnate-forked; sori not quite reaching the margin.

"Luzon," *Haenke;* Montalban, *Loher;* Mount Mariveles, *Copeland* 238, *Whitford* 234; Davao, *Copeland* 672, 701.

Pantropic.

The plants with erect root stalks and those with decumbent ones are undoubtably the same species.

(7) **D. grammitoides** Presl Epim. Bot., p. 84. Rhizome wide-creeping slender, chaffy; stipes 10 to 20 cm. high, gray-green, clothed throughout with light, slender scales; frond 15 to 25 cm. high, about 7 cm. wide, pinnate below, pinnatifid above; pinnæ acute, sessile, subauriculate, glabrous, membranaceous, cut half way to the costa into entire or dentate

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lobes; veins 4 to 7 forked; sori copious, the simple ones linear-oblong, the diplazioid oblong.

Luzon, *Cuming* 56; Baguio, *Topping* 156, *Loher*.

Malay Islands.

Presl says *Diplazium tenerum* is a related species from Leyte, *Cuming* 333 in part.

(8) **D. japonicum** Thunb. Rhizome slender, wide-creeping; stipe 15 to 30 cm. high, stramineous or brownish, slightly scaly towards the base; frond 25 to 35 cm. long, 10 to 15 broad, ovate-lanceolate, with 8 to 10 rather distant pinnæ below the pinnatifid apex, the lower ones sessile, 10 cm. long, 2 cm. broad, cut down in the lower part two-thirds of the way to the costa into close, oblong, slightly toothed lobes, herbaceous, nearly naked, both surfaces bright green; veins about 6 on each side in the lower lobes, with sori on each reaching two-thirds of the way to the edge, the lowest 3 mm. long, indusium broad, brown, tumid.

Davao, *Warburg* 14125.

Japan and Formosa to the Himalayas.

(9) **D. bulbiferum** Brack. (*Asplenium Brakenridgei* Bak.). Stipes 15 to 25 cm. high, firm, grayish, naked; frond 30 to 45 cm. long, 15 to 25 cm. broad, the apex pinnatifid, below this 6 to 9 pinnæ on each side, the lower ones 3 to 5 cm. apart and distinctly stalked, 10 to 12 cm. long, 2 cm. broad, acuminate, sharply serrate, cut down one-third of the way to the costa into blunt incised lobes 6 mm. broad, subcoriaceous; veins pinnate in the lobes; sori in long lines, reaching to the edge.

Philippines, *Cuming* 333, 388.

Fiji.

This is possibly *D. tenerum* Presl, from Leyte.

(10) **D. speciosum** Blume. Stipes tufted, 30 cm. or more long, firm, erect, stramineous or brownish, nearly naked; frond 30 to 60 cm. long, 20 to 30 cm. broad, with 10 to 20 pairs of pinnæ below the pinnatifid apex, the lower ones often stalked, 10 to 15 cm. long, 3 cm. broad, very acuminate, lobed down at least two-thirds of the way to the costa into close slightly toothed lobes 6 mm. broad, truncate or subcuneate at base, herbaceous but firm; veins pinnate in the lobes; sori reaching nearly to the edge.

Philippines, according to Synopsis Filicum.

Malaya, Hongkong.

(11) **D. sorsogonense** Presl Tent. Pterid., p. 114. Stipes tufted, 10 to 15 cm. high, densely fibrillose below; frond 30 to 60 cm. long, 20 to 30 cm. broad, with numerous pinnæ on each side, the lower ones sessile, 10 to 15 cm. long, 25 mm. broad, cut down regularly throughout two-thirds of the way to the costa into spreading, blunt, subentire lobes about 4 mm. broad, herbaceous; rachis slightly fibrillose; veinlets of the lobes simple, with sori in regular rows reaching from the midrib to the edge.

Sorsogon, *Haenke;* Leyte, *Cuming* 301.

Himalayas, Malacca.

(12) **D. petiolare** Presl Epim. Bot., p. 86. Stipe brown, smooth; frond about 50 cm. high, pinnate with pinnatifid apex; pinnæ about 12 cm.

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long, the lowest a little shorter but longer stalked, linear, acute, pinnatifid half way down to the costa, with equilateral, acute base, glabrous, herbaceous, bright green above, pale beneath; rachis densely beset with short patent hairs; veinlets all bearing sori.

Bohol, *Cuming* 349.

(13) **D. brachypodum** (Baker). Stipes tufted, slender, about 2 cm. high, dark green, with a few minute linear scales; frond oblanceolate, acuminate, 10 to 15 cm. long, 2.5 cm. broad, bipinnate; lower pinnæ lanceolate-deltoid, 6 mm. broad, distinctly stalked, square on upper side, cuneate-truncate on lower, cut down to rachis below, many lower distant, reduced; lowest anterior pinnule much largest, cuneate-oblong, dentate, 2 to 3 mm. broad, the others lanceolate, entire; texture moderately firm, surfaces dull green; rachis naked; veins pinnate in lower lobes; sori medial, linear.

Luzon, *Cuming* 56.

(14) **D. cyatheaefolium** (Bory) Presl. Caudex erect, subarborescent; stipe firm, erect, dark brown, nearly naked; frond 45 to 60 cm. long, 30 to 45 cm. broad, lower pinnæ 25 cm. long, 8 cm. broad, cut down to their rachis in the lower two-thirds into numerous pinnules on each side, the lower ones 4 cm. long, 1 cm. broad, the upper ones inciso-crenate, the lower ones cut down one-third of the distance to the costa into oblong, falcate, sharply-toothed lobes, herbaceous; veins pinnate, with 3 or 4 veinlets on each side in the lower lobes; sori falling considerably short of the edge.

Luzon, *Cuming* 158.

(15) **D. latifolium** (Don). Caudex erect, subarborescent; stipes tufted, strong, erect, 30 cm. or more high, livid, smooth, clothed toward the base with linear crisped, dark brown scales; frond 1 m. long, 30 to 45 cm. broad, subdeltoid, with about 12 pinnæ on each side, the largest 30 cm. long, 10 cm. broad; pinnules numerous, the largest 5 cm. long, 2 cm. broad at the base, acuminate, slightly toothed, abruptly truncate at the base on both sides, subcoriaceous; veins about 6 in a group; sori linear, the lowest often 4 mm. long.

Philippines.

Ceylon to Celebes and southern China.

(16) **D. vestitum** Presl Epim. Bot., p. 87. Rhizome erect; stipe stout, erect, brownish, tomentose, sometimes muricate; frond 60 to 90 cm. long, 25 to 45 cm. broad, with numerous pinnæ on each side, the lower ones 25 cm. long, 10 cm. broad, with numerous distinct subsessile pinnules, which are 5 cm. long, 25 mm. broad, blunt, bluntly lobed to a depth of 3 to 6 mm., base narrowed suddenly or even cordate, thin-herbaceous; rachis like the stipe; veins pinnate in the lobes, with 4 to 5 veinlets on each side; lower sori 6 to 8 mm. long, not reaching the margin.

Samar, *Cuming* 336.

Luzon specimens, *Merrill* 2667 from Rizal, *Copeland s. n.*, from Mount Mariveles, resemble this in their pubescent rachises, but have acute pinnules, and are very large, reaching a height of 3 m.

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(17) **D. deltoideum** (Presl) Christ. Caudex erect, clothed with black paleæ, and bearing stout roots; stipes about 20 cm. high, black and black-scaly at the base, glabrous and greenish above; frond 30 to 40 cm. high, two-thirds as wide, deltoid, with a few distant pinnæ; the lowest pinnæ about 12 cm. long, 5 cm. broad, bearing numerous subsessile pinnules; pinnules obtuse, lanceolate, cut two-thirds of the way to the costa into blunt lobes, glabrous, herbaceous; veins pinnate-forked in the lower lobes; sori rich-brown, reaching the margin.

Luzon, *Cuming* 29; Davao, *Warburg* 14126, *Copeland* 966, the Davao plant differing from the type in having narrower pinnæ and their rachis green.

Celebes.

(18) **D. meyenianum** Presl Epim. Bot., p. 86. Frond probably about 1 m. high, ovate-triangular, bipinnate; pinnæ 40 cm. long, alternate, stalked, oblong-lanceolate, acuminate; pinnules subsessile, linear-oblong, acuminate, pinnatifid three-fourths of way to costa into subopposite ovate-oblong subfalcate obtuse serrulate segments, glabrous, thin-coriaceous; veins pinnate-forked; rachis brown, channeled above; sori copious, reaching from the midrib nearly to the edge.

"Manila," *Meyen*, Arayat, 800 m., *Loher*. Christ distinguishes this from *D. polypodioides* by its thinner texture, broader, less serrate segments, and sori less lined up. A plant from San Ramon, Zamboanga, *Copeland* 734, agrees with Presl's diagnosis, but the sori are sparse and remote from the costa.

(19) **D. polypodioides** Blume. Caudex erect, subarborescent, densely clothed at the top with long, dark brown, fibrillose scales; stipes densely tufted, erect or spreading, ebeneous at the base, green above, stiff, muricate, 50 to 100 cm. high; frond 1 m. or more high, rather over half as wide, bipinnate; pinnæ alternate, the lower ones in large fronds reaching a length of 60 cm. and a breadth of 18 cm., bearing many alternate pinnules; pinnules stalked, acuminate, cut down almost to their costa into numerous linear-oblong obtuse more or less serrate segments, herbaceous or sub-coriaceous; veins pinnate in the segments, veinlets numerous, simple; sori in regular rows, usually falling considerably short of the margin.

Southern Luzon, *Baranda;* Isabela Province, *Warburg* 11618, 11623; Tarlac, *Hall;* Caraballo Sur, *Merrill* 233; Bataan Province, *Barnes* 132, *Copeland* 235, *Whitford* 194.

India and Malaya.

Forms corresponding to Blume's *D. asperum*, with rather coriaceous fronds are common, but not separable even as a variety.

(20) **D. ebenum** J. Sm. differs from *D. polypodioides* in having a slender naked ebeneus rachis, and erecto-patent lobes, with but 4 distinct veinlets in each.

Philippines, *Cuming* 159.

(30) **ASPLENIUM** Linnaeus.

Sori simple, usually confined to the acropetal side of the veins; indusium the shape of the sorus, and continuous across the vein in the few species

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in which the sorus curves across it. Ferns of the most various form, simple to finely dissected, growing in all situations, and all over the world. As construed here, it includes several sections the types of some of which are different enough to have been generically separated, but whose characters intergrade. Through § *Athyrium* it is closely related to *Diplazium*.

1. § *Neottiopteris;* frond simple, usually entire, elongate.
    2. Veins connected near margin (*Thamnopteris*)..... (1) *A. Nidus*
    2. Veins as a rule free.
        3. Frond entire, more or less coriaceous.
            4. Indusium leaving a ridge at dehiscence (2) *A. scolopendrioides*
            4. Indusium not leaving a ridge.
                5. Stipe scaly.
                    6. Frond acuminate or caudate ..... (3) *A. squamulatum*
                    6. Frond merely acute ..... (4) *A. apoense*
                5. Stipe naked ..... (5) *A. vittaeforme*
        3. Frond serrate, membranaceous ..... (6) *A. epiphyticum*
1. § *Euasplenium;* once or more pinnate, veins forked in segments, sori confined to one side of vein.
    2. Frond once pinnate.
        3. Pinnæ deep, not narrower than oblong.
            4. Rachis green, at least in part.
                5. Rachis pubescent ..... (7) *A. loherianum*
                5. Rachis glabrous.
                    6. Pinnæ auricled, frond narrow ..... (8) *A. toppingianum*
                    6. No auricles, frond broad .. (9) *A. subnormale*
            4. Rachis glossy, nearly black ..... (10) *A. normale*
        3. Pinnæ usually linear-oblong or linear.
            4. At least half of lower side of pinna cut away ..... (11) *A. resectum*
            4. Pinnæ equal sided at base.
                5. Herbaceous, dark green ..... (12) *A. multilineatum*
                5. Coriaceous, pale green ..... (13) *A. wightianum*
            4. Upper side of base of pinnæ nearly parallel with main rachis, lower side obliquely truncate.
                5. Veins conspicuous.
                    6. Frond herbaceous, dark green.
                        7. Apex of pinnæ rounded ..... (14) *A. tenerum*
                        7. Apex of pinnæ obtuse or acute.
                            8. Inciso crenate throughout .... (15) *A. lunulatum*
                            8. Upper side lobed at base ..... (16) *A. Steerei*
                        7. Apex of pinnæ acuminate.
                            8. Veins usually simple ..... (17) *A. prionurus*
                            8. Veins forked .... (18) *A. persicifolium*
                    6. Frond firmer, pale green.
                        7. Pinnules broad ..... (19) *A. griseum*
                        7. Pinnules narrow ..... (20) *A. hirtum*

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5. Veins inconspicuous.
6. Sori equal, at wide angle to costa ..... (21) *A. anisodontum*
6. Sori unequal, veins leaving costa at very acute angle.
7. Pinnæ only toothed.... (22) *A. macrophyllum*
7. Pinnae deeply lobed.
8. Stipe nearly smooth.
9. Sori almost reaching edge .... (23) *A. falcatum*
9. Falling well short of edge .... (24) *A. contiguum*
8. Stipe fibrillose.. (25) *A. crinicaule*
8. Stipe chaffy, sori costal .... (26) *A. caudatum*

2. Fronds more than once pinnate.
3. Stipe smooth.
4. Pinnules of lower pinnæ few..... (27) *A. cuneatum*
4. Pinnules of lower pinnæ many.
5. Pinnules inciso-serrate or lobed.. (28) *A. affine*
5. Pinnules cut to their rachis.
6. Segments inciso-serrate .... (29) *A. nitidum*
6. Segments deeply pinnatifid.. (30) *A. laserpitiifolium*
3. Stipe wooly ..... (31) *A. praemorsum*

1. § *Darea;* ultimate segments linear, with solitary simple veins.
2. Rhizome short, stipe long..... (32) *A. Belangeri*
2. Rhizome scandent, stipe short ..... (33) *A. scandens*

1. § *Athyrium;* sori more or less curved across their veins, sometimes horseshoe-shaped.
2. Indusia naked.
3. Small fern, pinnules round-oval, lobes narrow ..... (34) *A. Sarasinorum* var. *philippinense*
3. Large fern, pinnules elliptic-rhomboidal, lobes broad ..... (35) *A. nigripes*
2. Indusia ciliate ..... (36) *A. woodwardioides*

§ Neottiopteris.

(1) **A. (Thamnopteris) Nidus** L. Frounds 60 to 120 cm. long, 8 to 20 cm. broad, entire, acute or acuminate, tapering gradually into a short stem, midrib rounded on the back; coriaceous, glabrous; veins fine and parallel, 1 mm. more or less apart, their ends connected; sori reaching about half way toward the margin.

Luzon, *Haenke, Cuming* 59; southern Luzon, *Baranda;* Montalban, *Loher;* Baguio, *Topping* 299; Paragua, *Merrill* 722; Todaya, Davao, 1,000 m. *Copeland* 1261, 1296.

Mauritius to Japan and New Caledonia.

Asplenium Phyllitidis Don is a smaller form, usually bearing longer sori. Samar, *Cuming* 319.

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I am unable to locate *Thamnopteris stipitata* Presl, collected in Luzon by *Cuming* 195.

(2) **A. scolopendrioides** J. Sm. Rhizome 8 mm. in diameter, clothed with lanceolate, brown chaff; stipe 2 to 4 cm. high, scaly or almost naked, passing insensibly into the attenuate base of the frond; fronds 40 to 50 cm. high, 3 to 4 cm. broad, apex caudate, margin entire, texture subcoriaceous; veins oblique, usually simple, rather remote; sori reaching from the midrib to within 6 mm. of the margin; edge of the indusium leaving a distinct ridge on the lamina where it dehisces.

Philippines, *Cuming* 318; Baco River, Mindoro, *Merrill* 1810. (This decription adapted to Merrill's plant.)

The fern of *DeVore* and *Hoover* 329, from Mount Apo, differs most conspicuously in the indusium's leaving no prominent line where it dehisces, but the material in hand does not justify its description as a new species.

(3) **A. squamulatum** Blume. Stipe tufted, 5 to 10 cm. long, scaly below; frond lanceolate, 30 to 70 cm. long, 4 to 6 cm. broad, acuminate, base gradually attenuate to the stipe, entire or nearly so, lamina coriaceous, glabrous, midrib somewhat chaffy; veins inconspicuous, as a rule free; sori reaching from near midrib to within 1 cm. of the margin.

Southern Luzon, *Baranda;* Montalban, *Loher;* Todaya, Davao, 1,200 m., *Copeland* 1201, 1288.

Java, Borneo.

(4) **A. apoense** Copeland. Rhizome very short, erect; stipes clustered, stout, scaly, 1 to 5 cm. high, passing insensibly into the attenuate base of the frond; costa stout, scaly; frond 20 to 35 cm. high, 1.5 to 2.5 cm. broad, entire, acute, glabrous, coriaceous; veins inconspicuous, erecto-patent, usually forked; sori linear, reaching two-thirds of the way from the costa to the margin.

Mount Apo, Mindanao, 1,800 m., *Copeland* 1108; epiphytic in clumps.

(5) **A. vittaeforme** Cav. Rhizome creeping, naked; stipe short, erect, naked; frond lanceolate, 30 to 45 cm. long, 4 to 8 cm. broad, narrowed to an acute point and very gradually into the stem below, the margin obscurely toothed; texture coriaceous; veins simple, close, nearly horizontal, the copious sori often reaching from the midrib nearly to the edge.

Davao, *Warburg* 14112; southern Luzon, *Baranda.*

Java, Fiji.

The stipes are jointed to the rhizome, as in Polypodium.

(6) **A. epiphyticum** Copeland. Rhizome scandent, bearing scattered, minute scales; stipes about 8 cm. long, clothed with minute ferruginous scales; typical fronds simple, 20 to 30 cm. high, about 4 cm. wide, acuminate, base obtuse or subacute, margin serrate or crenate, texture membranaceous; costa stout, like the stipe; lamina glabrous; veins conspicuous, usually forked, almost transverse; sori linear, touching neither costa nor margin; younger plants bear fronds bi-tri-pinnati-dissected; and there are intermediate forms.

Davao, Mindanao, epiphytic on trunks in coast forest, *Copeland* 664.

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§ Euasplenium.

(7) **A. loherianum** Christ, Bull. Herb. Boissier 6(1898):152. Rhizome small; stipe very short; fronds only 2 to 5, scarcely 10 cm. high; rachis weak, flexuous, decumbent, pubescent with linear scales, base purple or green, apex rooting; pinnæ alternate, 12 to 18 on each side, very remote, 3 mm. long, ovate, deeply crenate-dentate; texture subfleshy; sori oblong, early confluent and covering the under side of the pinnæ.

La Trinidad, Benguet, *Loher* 99, on limestone.

(8) **A. toppingianum** Copeland. Rhizome creeping, chaffy; stipe 3 to 8 cm. high, the base brown and chaffy, upward becoming like the rachis, green and glabrous; fronds 10 to 15 cm. high, 2 to 2.5 cm. broad, herbaceous, glabrous, acuminate, apex not rooting, pinnate; about 6 pairs of pinnæ free but sessile, and as many more connected by a wing widening toward the cleft apex; pinnæ smooth, thin, oblong, obtuse, serrate-crenate, acroscopic half of lower pinnæ auricled at base; sori mostly not confluent, straight and confined to the one side of the vein, or curved and even horseshoe-shaped.

Baguio, *Topping* 284, *Elmer* 5787.

A. toppinglanum var. **mistum** Copeland. Differs from the type in being larger, with the teeth of the pinnæ more rounded, and especially in the lowest pair of pinnæ, which are of more than twice the dimensions of those above, and deeply incised.

Baguio, with the type, *Topping* 194.

(9) **A. subnormale** Copeland. Fronds solitary or few on a short, creeping, terrestrial rhizome; stipe about two-fifths of the total height, smooth except at the base, slender, seldom straight, dark and polished, but shading into a green rachis with green lateral lines representing wings; frond 4 to 9 cm. high, lanceolate-ovate, acute, apex not rooting, pinnate; distinct pinnæ about 6 pairs, 2 or 3 more pairs indicated by clefts, the lowest smaller than or equalling the next above, crenate, mostly trapezoid, irregular in shape, but the lower half of the pinnæ always cut away to the midrib at the base, the base of the acroscopic half parallel to the rachis: sori 6 or less to the pinna, not confluent; indusia narrow.

Lamao River, Bataan Province, *Copeland* 236, 1395.

(10) **A. normale** Don. Stipe 2 to 6 cm. long, tufted, wiry, blackish, polished; frond 10 to 25 cm. long, 10 to 17 mm. broad, with very numerous close-placed pinnæ, the lower ones reduced and deflexed, the point obtuse, the edge inciso-crenate, the upper side auricled and narrowed suddenly at the base, the lower truncate in a straight line; texture herbaceous; rachis glossy, nearly black; veins mostly once forked; sori in two unequal parallel rows.

Benguet, *Loher*, *Elmer* 6537.

Madagascar to Japan.

Christ inclines to regard this as a form of *A. Trichomanes*, to which the Benguet plants are very close. This description is adapted to our plant.

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(11) **A. resectum** Smith. Rhizome slender, creeping on ground; stipes scattered, slender, 10 to 25 cm. high, dark brown, polished; fronds 20 to 30 cm. high, 6 cm. broad, acuminate with numerous subsessile pinnæ, the lowest not reduced; pinnæ with more than half of the basiscopic side cut away, base of upper side truncate at a right angle, rather obtuse, margin inciso-crenate except the part cut away, membranaceous, glabrous; rachis like the stipe or sometimes green above; veins once or twice forked; sori not touching either costa or edge.

Luzon, *Cuming* 110; Tonglon 2,250 m., *Loher;* Isabela Province, *Warburg* 11607; Davao, *Copeland* 955, 1112.

Africa to Hawaii.

(12) **A. multilineatum** Hook. Stipe 15 cm. high, firm, erect, naked, grayish green; frond 30 to 45 cm. long, 15 to 20 cm. broad, oblong-lanceolate, with a long linear-lanceolate terminal pinna and 9 to 18 lateral ones on each side, which are 10 to 15 cm. long, 12 to 20 mm. broad, acuminate, the edge faintly toothed, but the point more deeply, the base cuneato-truncate with a short petiole; texture herbaceous; color dark-green; rachis naked; veins mostly simple, with sori on each reaching from the midrib to the edge.

Tonglon 2,250 m., *Loher.*

Samoa and Fiji.

(13) **A. wightianum** Wall. Stipes tufted, 15 to 25 cm. high, greenish, naked; frond 30 to 45 cm. long, 15 to 20 cm. broad, oblong-lanceolate, with 6 to 9 pinnæ on each side, which are distinctly stalked, and the lowest 5 cm. apart, 12 to 15 cm. long, 12 to 18 mm. broad, acuminate, irregularly crenate, the base gradually truncato-cuneate, equal on both sides; texture coriaceous; color pale green; veins inconspicuous, distant, often forked; sori distant, falling short of the edge.

Luzon, *Steere.*

Madras and Ceylon.

(14) **A. tenerum** Forst. Stipes tufted, firm, erect, grayish, nearly naked, 6 to 25 cm. high; frond 10 to 40 cm. long, 3 to 12 cm. broad, oblong-lanceolate, with 10 to 25 stalked horizontal pinnæ on each side, which are 1½ to 4 times as long as broad, bluntly rounded at the point, the edge deeply toothed throughout, the two sides unequal, the upper one narrowed almost at a right angle, sometimes slightly auricled, the lower one very obliquely truncate, lower pinnæ deflexed; texture herbaceous; rachis compressed; veins usually simple; sori numerous, regular, parallel, not reaching either edge or midrib.

Maquiling, *Loher;* Davao, *Warburg* 14146; Baco River, Mindoro, *Merrill* 1771 (very large); Gimogon River, Negros, *Copeland* 78; Mount Mariveles 1,050 m., *Copeland* (very small).

Ceylon across Polynesia.

This fern varies widely in stature, but is comparatively constant in other respects.

(15) **A. lunulatum** Swartz. Stipes tufted, 5 to 10 cm. high, firm, nearly naked, gray or ebeneous; frond 15 to 45 cm. long, 3 to 5 cm.

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broad, narrowly lanceolate-oblong, with 12 to 20 horizontal pinnæ on each side, which are 3 to 4 cm. long, 1 cm. broad, bluntish or acute at the point, more or less deeply inciso-crenate throughout, the two sides unequal, the upper one at the base narrowed suddenly at about a right angle, the lower one obliquely truncate; lower pinnæ often deflexed; texture herbaceous; rachis firm, grayish; veins simple or once forked; sori falling short of both edge and midrib.

Mountains of Panay, *Steere.*

Tropics, everywhere.

(16) **A. Steerei** Herrington. Stipe dark gray, 12 to 15 cm. high, firm, with a few small, brown, scattered scales; frond 20 to 25 cm. long, 5 cm. broad, oblong-lanceolate; pinnæ 12 to 15 on each side, short petioled, 3 to 5 cm. long, 1 cm. broad, apex acute, margin coarsely crenate, unsymmetrical; upper side abrupt at the base with a more or less distinct large lobe; lower side obliquely truncate; lower pinnæ slightly deflexed; texture firm, herbaceous; surface dark green above, brownish below; veins distant, simple, or once forked; sori 2 to 8 in a row on each side of the midrib, regular, falling a little short of midrib and margin.

Mount Majayjay, Luzon, *Steere,* in small clusters on tree trunks.

(17) **A. prionurus** J. Sm. Stipes tufted, 15 to 25 cm. high, firm, erect, slightly scaly below; frond 30 to 45 cm. long, 15 to 25 cm. broad, oblong, with 9 to 18 pinnæ on each side, which are 10 to 15 cm. long, rather over 1 cm. broad, very acuminate, deeply and regularly toothed throughout, the base rather unequal, more truncato-cuneate on the lower side, with a short, distinct petiole on the lower ones; texture herbaceous; veins usually simple, with sori on each reaching nearly to the edge.

Philippines, *Cuming* 197.

Ferns collected by DeVore and Hoover, 348 and 377, from Mount Apo, probably represent this species, but are too imperfect for certainty; they seem equally near *A. lineatum* Swartz, indicating, as is suggested in Synopsis Filicum, that the two species are not distinct.

(18) **A persicifolium** J. Sm. Stipe and rachis gray, with a few scattered minute gray scales; frond oblong-lanceolate, 60 to 90 cm. long, often gemmiparous at apex; pinnæ distant, ascending, 15 to 30 jugate, subpetiolate, 10 to 12 cm. long, linear-ligulate-acuminate, 1 to 2 cm. broad, distinctly inciso-crenate throughout, more cuneate on the lower than on the upper side at the base, the lowest not reduced; texture thin but firm; surfaces dark green, naked; veins erecto-patent, fine, forked, not close; sori regular, parallel, 6 to 8 mm. long, reaching nearly to midrib and edge.

Southern Luzon, *Baranda.*

Formerly accredited to Hawaii, but incorrectly, according to Hillebrand, Flora of Hawaiian Islands, p. 591.

(19) **A. griseum** Copeland. (*A. insigne* Copeland in Perkin's Fragmenta, not of Blume nor Liebm.) Rhizome short, stout, densely coated with large, brown scales; stipe 40 to 50 cm. high, stout, dark green or brown, slightly chaffy; frond 30 cm. broad, more than 60 cm. high, pinnate; pinnæ about 12 pairs, stipitate, about 20 cm. long by 3.5 deep, lanceolate, acuminate, subserrate, tough-herbaceous, ash-green, somewhat unequal at

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the base, cuneate below, truncate-cuneate above; veins oblique, usually forked, conspicuous, sori large, close to the midrib and reaching half way to the margin.

Davao, Mindanao, on rocky bed of Sibulan River, altitude, 700 m., *Copeland* 983.

The apex of fertile fronds often wanting.

(20) **A. hirtum** Kaulf. Stipes tufted, 5 to 10 cm. high, strong, erect, brownish, deciduously fibrillose; frond 30 to 60 cm. long, 10 to 20 cm. broad, with very numerous horizontal pinnæ on each side, which are 5 to 8 cm. long, 1 cm. broad, acuminate, broadly not deeply toothed, the base on the upper side conspicuously auricled, on the lower side rather suddenly but obliquely narrowed; texture coriaceous; rachis dark colored, strong, more or less fibrillose; veins oblique (Syn. Fil. says inconspicuous; Diels says evident); sori in two regular rows, which fall considerably short of the edge.

Mount Mariveles, *Merrill* 3760, *Barnes;* Mount Arayat, *Merrill* 3816, *Topping;* southern Luzon, *Baranda;* Mount Apo, *DeVore* and *Hoover* 319.

Madagascar to Polynesia.

A. hirtum Kaulf. var. **repressum** Copeland. Differs from the type in being smaller, less than 20 cm. high, almost sessile, and having obtuse pinnæ.

Mount Mariveles, 1,200 m., on exposed ridges, *Merrill* 3212.

Asplenium meyenianum Presl, Epim. Bot. p. 73, said to differ from *A. hirtum* in the serration of the pinnæ and the form of the pubescence is probably not really separable from it.

Manila, *Meyen, Cuming* 147.

(21) **A. anisodontum** Presl. Stipes tufted, firm, erect, gray, naked or slightly fibrillose; frond 30 to 45 cm. long, 10 to 15 cm. broad, with numerous horizontal or subfalcate sessile pinnæ on each side, which are 5 to 8 cm. long, 1 cm. broad, acuminate, inciso-crenate, the base on the upper side auricled and narrowed rather obliquely, on the lower side obliquely truncate; texture subcoriaceous; rachis firm, erect; veins oblique, mostly once branched; sori parallel, in two regular rows, reaching nearly from the midrib to the edge.

Luzon, *Cuming* 128.

Java.

No. 334 of DeVore and Hoover, from Mount Apo (but from no such altitude as their label states) may be *A. anisodontum*, but is serrate, not crenate; many pinnæ have a free lobe in the place of an auricle, as *A. Steerei* is described.

(22) **A. macrophyllum** Swartz. Stipes tufted, 15 to 30 cm. high, stout, erect, brownish, nearly naked; frond 15 to 45 cm. long, 15 to 30 cm. broad, with 6 to 12 opposite pairs of stalked nearly horizontal pinnæ, which are 10 to 20 cm. long, 3 to 8 cm. broad, acuminate, sharply serrate, the two sides nearly equal, but the lower one narrowed rather more obliquely; texture subcoriaceous; rachis naked, firm, erect; veins very oblique; sori in close long parallel lines reaching from the midrib nearly to the margin.

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Masbate and southern Luzon, *Baranda;* Montalban, *Loher;* Mariveles, 1,400 m., *Loher, Whitford* 275; Culion, *Merrill* 509. *Elmer's* 6147, from Baguio, is a small form of this.

India across Polynesia.

(23) **A. falcatum** Lam. Rhizome short-creeping; tipes tufted, 10 to 15 cm. high, firm, erect, dark grayish, nearly naked; frond 15 to 35 cm. high, 7 to 15 cm. broad, with 6 to 12 stalked pinnæ on each side, which are 4 to 7 cm. long, 1 to 1.5 cm. deep, acuminate, shallowly lobed and lobes toothed, inequilateral, lower side very obliquely truncate, texture coriaceous; rachis almost naked; veins very oblique; sori reaching almost to margin.

Luzon, *Haenke;* Calolbon, Catanduanes, *Baranda.*

Zambesi Land to New Zealand and Polynesia.

A. chamissonianum Presl, collected "at Manila" by *Chamisso* and *Meyen,* may be a form of *A. falcatum.*

(24) **A. contiguum** Kaulf. Stipes tufted, 15 to 25 cm. high, firm, erect, chestnut-brown, naked; frond 30 to 45 cm. long, 10 to 15 cm. broad, with 20 to 30 horizontal subfalcate pinnæ on each side, which are acuminate, more or less deeply inciso-serrate or lobed, the base narrowed suddenly, and sometimes auricled on the upper, obliquely truncate in a curve on the lower side; texture subcoriaceous; rachis firm, naked or slightly villose, chestnut-colored; veins oblique, obscure; sori close, copious, falling considerably short of the margin.

Arayat, 800 m., *Loher;* Montalban, *Loher;* Baguio, *Topping* 317.

Hawaii, Hindostan.

A. contiguum, var. **bipinnatifidum** Christ, Bull. Herb. Boiss. 6 (1898); 152. Pinnæ again pinnate at the base; pinnules cuneiform, auriculate, deeply dentate; looking like a hybrid between *A. contiguum* and *A. affine* Sw.

Arayat, 800 m.; Tonglon, 1,900 m., *Loher.*

A. lepturus Presl, Epim. Bot., p. 72, is described as differing from *A. contiguum* in the form of the frond, which is lanceolate, about 20 cm. high, and in the incision of the pinnæ into sharply and inequally serrate, truncate lobes; the sori seem to be costal, as in *A. caudatum.*

Luzon, *Cuming* 211.

(25) **A. crinicaule** Hance. Stipes densely tufted, 8 to 10 cm. long, erect, dark brown, slightly fibrillose; frond 15 to 20 cm. long, 4 cm. broad, with 9 to 15 horizontal pinnæ on each side, which are 2 cm. long, hardly 1 cm. broad, bluntish, irregularly inciso-crenate, the upper side narrowed suddenly, sometimes auricled at the base, the lower obliquely truncate; texture subcoriaceous; rachis firm, slightly fibrillose, no distinct midrib; veins subflabellate; sori few, linear, very oblique.

Davao, *Warburg* 14163 and 14178.

India, southern China.

(26) **A. caudatum** Forst. Rhizome very short, adscendent; stipes tufted, 6 to 15 cm. high, firm, erect, densely clothed with fine, brown fibrillose scales; frond 15 to 35 cm. high, 8 to 16 cm. broad, with 20 to 30 pinnæ on each side, the point acuminate, the edge deeply toothed sometimes

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lobed more than half way down to the rachis in the lower part, the two sides unequal, the upper auricled and narrowed suddenly, the lower very obliquely truncate at the base; texture coriaceous; rachis deciduously villose; veins very oblique; sori subflabellate.

Arayat, 800 m.; Tonglon, 2,250 m.; Mariveles, 1,400 m., and Montalban, *Loher*, pinnæ strongly auricled, resembling *A. dimidiatum*, but the point acuminate; Nueva Vizcaya, *Merrill* 295; Baguio, *Topping* 266.

Tropics, around the world.

A. polyodon Forst., collected at Sorsogon by *Haenke* and in Laguna by *Cuming*, and *A. zamiæfolium* Presl, collected at Sorsogon by *Haenke*, are hardly separable by the descriptions from *A. caudatum*. *Tarachia truncatiloba* Presl is also the plant commonly called *A. caudatum*—on the assumption that the real *A. caudatum* Forst. is not, as Presl states, *A. horridum* Kaulf.

(27) **A. cuneatum** Lam. Stipes tufted, 15 to 25 cm. high, firm, erect, naked; frond 15 to 40 cm. long, 15 to 25 cm. broad, with numerous spreading pinnæ on each side, the lower ones 10 cm. long, 3 cm. broad, lanceolate-deltoid, cut down to the rachis into several distinct ovate-cuneate pinnules, which are inciso-dentate and cut down in the lower part nearly or quite to the rachis; texture subcoriaceous; rachis firm, grayish, nearly naked; veins fine, conspicuous on the upper surface; sori linear, subflabellate.

Davao, *Warburg* 14144; Maquiling, *Loher*.

Tropics, everywhere.

See comment under *A. laserpitiifolium*.

(28) **A. affine** Swartz. Stipe 15 to 30 cm. high, firm, erect, gray, nearly naked; frond 30 to 45 cm. long, 15 to 30 cm. broad, with numerous pinnæ on each side, the lower ones lanceolate-rhomboidal, cut down to the rachis into numerous distinct rhomboidal pinnules, which are again inciso-serrate or deeply lobed; texture subcoriaceous; rachis firm, naked; veins subflabellate; sori copious, linear.

Luzon, *Steere;* Mount Mariveles, 1,400 m., *Loher*.

Ceylon to Hawaii.

(29) **A. nitidum** Swartz. Stipe stout, erect, grayish-black, naked; frond 6 to 10 dm. high, with numerous lanceolate-deltoid pinnæ, the lowest of which are 20 cm. long, 8 cm. deep, with numerous stalked subdeltoid pinnules, which are again cut down to their rachis into broad, flabellato-cuneate segments inciso-serrate round the outer edge; texture subcoriaceous; rachis stout, gray, naked; veins channeled, flabellate; sori short, radiant.

Montalban, Marambibi, *Loher*.

India and Malaya.

This description covers two ferns.

(30) **A. laserpitiifolium** Lam. Stipes tufted on an erect scaly root-stalk, 20 to 40 cm. high, stout, erect, gray-black, naked; fronds reaching a length of above 1 m., by one-third as broad, with numerous pinnæ; the lowest pinnæ deltoid-lanceolate, with numerous stalked pinnules, the lowest of which are again pinnate, and their segments incised or pin-

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natifid; texture herbaceous; veins fine, deeply channeled; sori short, linear-oblong, irregular.

Luzon, *Cuming* 43, *Chamisso;* southern Luzon, *Baranda;* Montalban, *Loher;* Batangas, *Marave;* Bataan Province, *Barnes* 153; Mindoro, *Merrill* 1814; Mindanao, *Née.*

India, across Polynesia.

This and the preceding three species are decidedly too near together. Young plants of *A. laserpitiifolium,* and plants in poor situations, bear fronds indistinguishable from those of the less dissected species. Thus plants from Davao that would very probably have become typical *A. laserpitiifolium* bear fronds smaller and less dissected than typical *A. cuneatum;* and the same is true of Elmer's 6538, from Benguet.

(31) **A. praemorsum** Swartz. Stipes tufted, 10 to 20 cm. high, firm, erect, wooly; frond 15 to 45 cm. long, 10 to 15 cm. broad, with 12 to 20 pinnæ on each side, which are lanceolate-deltoid in general outline, 5 to 8 cm. long, 2 cm. broad, cut down throughout nearly or quite to their rachis into linear-cuneate pinnules, which are sharply serrate on the outer edge; texture coriaceous; rachis firm, erect, more or less fibrillose like the stem; veins deep-channeled, flabellate; sori linear, radiant.

Arayat, 800 m., *Loher.*

Most tropical countries.

Specimens from Mount Apo, *Copeland* 1195, differ in that the pinnules are ovate-cuneate, giving a very different appearance.

§ Darea.

(32) **A. Belangeri** Kunze. Stipes tufted on a very short, chaffy root-stalk, erect, 15 to 30 cm. high, greenish, naked except near the base; frond 30 to 40 cm. high, 10 to 12 cm. broad, with numerous horizontal pinnæ about 6 cm. long, 1.5 cm. deep, obtuse, the basiscopic side obliquely truncate at the base, acroscopic somewhat auricled; cut down throughout to a regularly winged rachis into linear, erecto-patent segments 1 mm. broad separated by more than their breadth, the lowest of which are once or twice forked; texture subcoriaceous; color pale green; rachis compressed; one vein and sorus to each segment, the latter marginal.

Davao, *Warburg* 14133 and 14164, *Copeland* 1198.

Sumatra to Amboyna.

The Davao plants, to which this description is adapted, differ from the typical in being broader, in the frequently more than once forked lower segments, the chaffy base of the stipe, and thinner texture.

(33) **A. scandens** J. Sm. Mett. Stipes scattered on a stout scandent rhizome, very short; frond 30 to 60 cm. long, 15 to 30 cm. broad, with numerous horizontal pinnæ, which are 10 to 15 cm. long, 4 cm. broad, cut down to a distinctly winged rachis into numerous subdistant ovate-rhomboidal pinnules, which are cut down to a rachis throughout; lower segments again pinnatifid; ultimate divisions narrowly linear; texture thinly herbaceous; rachis firm, erect; one vein in each division; sori solitary, marginal.

Leyte, *Cuming* 297.

New Guinea.

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§ Athyrium.

(34) **A. (Athyrium) Sarasinorum** (Christ Ann. Jard. Bot. Buitenz. 15(1898):123, var. **philippinense** (Christ Bull. Herb. Bois. 6 (1898): 154). Caudex short, bearing long, dark-brown scales; stipes 3 to 6 in a cluster, slender, weak, brown, sparsely scaly, 15 cm. or more high; frond above 10 cm. high, two-fifths as broad, acute, tripinnatifid; pinnæ 10 or more on each side, alternate, the lowest the longest; pinnules sessile or the lowest short stalked, round-oval, divided to the costa below into segments which in turn are incised into linear-lanceolate subacute lobes; sori 1 to each lobe, slightly curved, with oval, loose, brown indusia.

Mount Data, Benguet, 2,250 m., *Loher*.

The type of the species in Celebes.

(35) **A. (Athyrium) nigripes** Blume. Stipes tufted, 15 to 30 cm. high, stramineous, erect, scaly below; frond 30 to 60 cm. long, 20 to 30 cm. broad, ovate-lanceolate, with numerous pinnæ on each side, the lowest lanceolate, 15 to 25 cm. long, 4 to 5 cm. broad, cut down to the rachis into numerous elliptico-rhomboidal pinnules, which are broadly lobed about half way down and the lobes slightly toothed; texture herbaceous; lateral veins of the segments forked; sori linear-oblong, often curved, 2 to 3 mm. long, principally in two parallel rows close to the midrib of the pinnule.

Mount Arayat, 800 m., *Loher*.

India to Java and Japan.

(36) **A. (Athyrium) woodwardioides** (Presl) Baker. Stipe firm, erect, naked, dark chestnut-brown; frond 60 to 100 cm. long, 30 cm. or more broad; lower pinnæ 15 to 25 cm. long, 8 cm. broad; pinnules lanceolate, slightly stalked, 4 cm. long, 1 cm. broad, cut down two-thirds of the way to the costa into linear-oblong, subfalcate, finely toothed lobes, herbaceous, glabrous; veins pinnate in the lobes, with 4 to 5 veinlets on a side, the upper ones forked, ends clavate; sori oblong, confined to the lower lobes close to the costa and not reaching more than half way to the margin.

Luzon, *Cuming* 153; Baguio, *Loher*.

Java.

(31) TRIPHLEBIA Baker.

Veins free; sori borne on a special receptacle between two parallel veins; indusium double, each bounding vein bearing half of it, opening regularly down the middle. Our two species are exclusively Philippine.

(1) **T. longifolia** (Presl) Baker. Differs from the following species only in that the frond is simple and entire, and the line where the two halves of the indusium meet is not emphasized.

Luzon, *Haenke;* Sorsogon, *Baranda;* Davao, *Warburg* 14117.

(2) **T. pinnata** (J. Sm.) Baker. Stipe compressed, grayish; frond 50 to 120 cm. long, lanceolate-deltoid, rooting at the apex, with an entire or finely crenate terminal pinna and 1 to 6 pairs of similar lateral ones, glabrous, subcoriaceous; veins usually once forked; sori numerous, oblique, linear, the indusium ridged where the halves meet.

Philippines, *Cuming* 187, 311; Biga, Catanduanes, *Baranda*.

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(32) STENOCHLAENA J. Smith.

High-scandent ferns, with pinnate dimorphous or polymorphous fronds; veins free near the margin; sori parallel to the costa, finally spreading over the whole under surface; indusium wanting. The stipe in some species is segmented to the rhizome, as in *Polypodieæ*. *Stenochlaena* is not very evidently related to any other genus.

1. Stipes articulate to the rhizome.
   2. Rhizome scaly, frond herbaceous ..... (1) *S. sorbifolia*
   2. Rhizome naked, frond coriaceous ..... (2) *S. palustris*
1. Stipes not articulate to rhizome..... (3) *S. laurifolia*

(1) **S. sorbifolia** (L.) J. Sm. Rhizome climbing indefinitely high, woody green, muricate, bearing few hard brown scales (roots?); stipes obscurely articulate to rhizome, 10 to 30 cm. long, stramineous with or without a conspicuous umber line; frond simply pinnate, the segments articulate to the rachis on stalks about 1 cm. long; sterile pinnæ 15 cm. long, nearly 2 cm. broad, acuminate, entire or obscurely serrate, base cuneate, glabrous, herbaceous or subcoriaceous; fertile pinnæ 20 cm. long, filiform.

Castillo, 800 m., and Mariveles, 1,400 m., *Loher;* foot of Mariveles, *Barnes Forestry Bureau* 368; Isabela Province, *Warburg* 11600, 11974, 11978; Paragua, *Merrill* 773; Davao, *Warburg* 14107, 14108, 14111.

Pantropic.

Beside the sterile fronds described above, bipinnate variously incised or divided ones also occur.

S. haenkeana Presl is a dubious species described from the sterile plant alone; the pinnæ are elliptic-oblong, abruptly acuminate, rounded at the base, the terminal twice as large as the lateral; rhizome and base of stipe clothed with peltate scales.

Sorsogon, *Haenke.*

(2) **S. palustris** (L.) Mett. Rhizome climbing indefinitely, scaleless; stipes naked, 15 to 30 cm. long; fronds 50 to 80 cm. long the sterile rather the larger, pinnate, with almost sessile pinnæ articulate to the rachis; pinnæ of sterile frond 10 to 12 cm. long, 2.5 cm. broad, finely but sharply serrate, subcoriaceous, the two sides at the base forming a right angle; segments of the fertile frond 15 to 20 cm. long, 3 mm. broad, the lower ones remote.

Luzon, *Haenke, Cuming* 133; Davao, *Copeland* 532.

India to Queensland and Fiji.

S. juglandifolia Presl is described as differing from *S. palustris* in having longer naked petioles, the sterile pinnæ rounded at the base, fertile pinnæ leafy at the base, and muricate stipes; it is usually regarded as only a form of the same species.

Luzon, *Haenke, Cuming* 133 in part.

(3) **S. laurifolia** (Hook.) Diels. Stipes firm, erect, naked; frond 60 to 90 cm. long, 30 to 45 cm. broad, simply pinnate; sterile pinnæ 15 to 25 cm. long, 4 cm. broad, narrowed gradually from the cordate base to

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the apex, sharply but finely toothed, sessile, not articulate to the rachis and without a gland, coriaceous, glabrous; fertile pinnæ 15 to 25 cm. long, about 1 cm. broad, the lower ones 1 cm. apart.

Luzon, *Cuming* 226.

Solomon Islands.

S. fraxinifolia Presl Epim. Bot., p. 164. Pinnæ stalked; the sterile oblong-lanceolate, acuminate, subacute and equal at the base; fertile pinnæ narrowly linear. This plant is included by J. Smith under *S. scandens*, and placed by Presl close to *S. laurifolia*, but with a different characterization of the latter from that just given.

Negros, *Cuming* 347.

(33) **BLECHNUM** Linnaeus.

Sterile fronds with free veins (except in *B. areolare*), fertile with a series of areolæ along the costa, otherwise free; sori along the far side of these areolæ, linear, usually continuous, parallel to the costa, sometimes spreading over the parenchyma; indusium the shape of the sorus, opening on the costal side. Mostly terrestrial ferns of moderate size, with erect caudices. The two sections are usually treated as genera, but are not sufficiently distinct.

1. § *Eublechnum:* sori close to the costa; fertile and sterile fronds not exceedingly different.
   2. Fronds pinnatifid ..... (1) *B. nitidum*
   2. Fronds pinnate.
      3. Lower pinnæ contracted at base..... (2) *B. orientale*
      3. Pinnæ with spreading, adherent base..... (3) *B. egregium*

1. § *Lomaria:* sori occupying most of the space from costa to margin; fronds decidedly dimorphous.
   2. Simply pinnate.
      3. Sterile frond with costal areolæ..... (4) *B. areolaris*
      3. Sterile frond with free veins..... (5) *B. capense*
   2. Bipinnate ..... (6) *B. Fraseri*

(1) **B. nitidum** Presl. Stipes stout, erect, naked, 10 cm. high; frond oblong-lanceolate, 30 cm. or more long, 10 to 15 cm. broad; pinnæ numerous, erecto-patent, subfalcate, linear, 10 cm. long, 1 cm. broad, narrowed gradually toward the point, dilated and connected at the base, the edge undulato-crenate, the lower ones linear-acute and not much smaller than the rest; texture coriaceous, both surfaces and rachis naked; veins fine; sori in a continuous line close to the midrib; indusium conspicuous.

Luzon, *Cuming* 164; Sorsogon, *Haenke.*

India, Polynesia, southern Brazil.

(2) **B. orientale** L. Caudex erect, often subarborescent, clothed at the crown with fibrillose, dark-brown scales; stipe 15 to 30 cm. high, strong, erect, scaly at the base; frond 40 to 100 cm. high, ovate, with very numerous close linear pinnae; pinnae 10 to 25 cm. long, 1 cm. broad, narrowed to a long point, contracted to a sessile base, the upper ones decurrent, the lowest abruptly reduced to mere auricles strung along the stipe; subcoriaceous, glabrous; sori in a long continuous line close to the midrib.

Isabela, *Warburg* 11975; Benguet, *Loher, Elmer*, 5824, *Topping* 243, 298;

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Nueva Vizcaya, *Merrill* 256; Culion *Merrill* 480; Panay, *Copeland* 56; Basilan, *DeVore* and *Hoover* 56.

India to Australia and Polynesia.

The following species are included under *Blechnum orientale: B. cumingianum* Presl, Luzon, *Cuming* 257, 259, 166; *B. pyrophyllum* Blume, Luzon, *Meyen; B. elongatum* Presl, Manila, *Meyen; Blechnopsis stenophylla* Presl, Luzon, *Cuming* 165, in part. **B. salicifolium** Kaulf., collected "at Manila" by *Chamisso*, I have not been able to locate.

(3) **B. egregium** Copeland. Stipes clustered in form of a nest, 10 to 20 cm. high, stout, brown, black below and densely clothed with long black scales; frond about 1 m. high, 30 cm. broad, pinnate, glabrous, moderately dimorphous; pinnæ acuminate, serrate, confluent at the top, lower down attached to the rachis by a broad base but distinct, at the bottom reduced gradually to remote auricles; fertile pinnæ coriaceous, 15 cm. long, 15 to 20 mm. broad next the rachis, contracted gradually until the sorus occupies very nearly the whole breadth; pinnæ of the sterile frond thinner but broader; indusia coriaceous, persistent.

Sibulan River, Davao, along mountain creeks, *Copeland* 1314.

(4) **B. areolaris** (Harrington, Journ. Linn. Soc. 16:28). Caudex long, slender, twisted, naked; stipe 15 cm. long in the sterile, nearly twice as long in the fertile fronds, glabrous; barren frond ovate, 10 to 15 cm. long, 10 cm. broad, pinnate; pinnæ 7 to 9, lateral nearly sessile, terminal stalked, linear-lanceolate, 5 to 8 cm. long, 12 to 16 mm. broad, acute, finely serrate, obtuse or rounded at the base; texture coriaceous; nerves forming a series of arches close to the midrib, thus forming on each side a row of long narrow areolæ parallel to the midrib; beyond this, nerves are free and simple or forking; surface naked, except that the midribs and nerves are a little chaffy below; fertile pinnæ 7 to 9, narrowly linear, 4 to 5 cm. long, rather distant; indusium narrow, marginal.

Mount Majayjay, growing among the leaves of a *Pandanus, Steere.*

(5) **B. capense** (L.) Schlecht (*Lomaria procera* Spr.). Caudex stout, woody, elongate, clothed with large ovate or lanceolate-acuminate ferruginous scales; stipe 15 to 30 cm. high, stout, erect, scaly below; frond 30 to 100 cm. high, one-third as broad, the fertile and sterile not always very different, coriaceous; pinnæ of sterile frond linear, the lower stalked, with rounded or cordate base, acuminate; fertile pinnæ narrowly linear; indusium broad, membranaceous, ciliate, sometimes slightly intramarginal; rachis densely chaffy.

Luzon, *Cuming* 141.

Southern Hemisphere and Mexico.

(6) **B. Fraseri** (Cunn.) Mett. var. **philippinense** (Christ). Caudex arborescent, 0.5 to 1.5 m. high, 1 to 2 cm. thick, black, clothed with lanceolate-ovate, dark brown, subulate scales 3 mm. long, and above with the bases of stipes, flexile, woody, bearing a crown of 6 to 8 fronds; stipe short, 3 to 4 cm. long, densely scaly; frond 40 cm. long, 20 to 25 cm. broad, long-acuminate, attenuate to the base; pinnæ about 12 to 18 on each side, alternate, 1 to 2 cm. broad with their own breadth between them, strongly

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decurrent, cleft almost to the costa into crowded lobes; lobes scarcely 1 cm. long, half as broad, triangular-oblong, subfalcate, finely but acutely serrate; rachis bearing triangular, often bifurcate lobes between the pinnæ; sori linear, midway between the margin and midrib of the lobe but soon occupying the entire lamina; indusium narrow, gray, evanescent.

Central Cordillera of Luzon, gregarious, apparently fruiting rarely, *Loher*.

Type of the species in New Zealand.

(34) WOODWARDIA Smith.

Veins anastomosing to form a series of areolæ along the costa, and in our species several series of similar areolæ between this and the margin; sori linear-oblong, one occupying each costal areola, the indusium opening toward the costa. Large terrestrial ferns with bipinnatifid fronds.

(1) **W. radicans** (L.) Smith. Rhizome short, erect; stipe 40 to 100 cm. high, strong, naked except at the base; frond 1 m. or more high, one-third as wide; pinnæ broadly lanceolate, acuminate, subsessile, cut down almost to the costa into narrowly linear segments serrate toward their apices, subcoriaceous.

Benguet, *Loher*, *Elmer* 6512.

Warmer parts of Northern Hemisphere.

Our plant is intermediate between *W. radicans* as originally described and *W. orientalis* Swartz of Japan and Formosa, which is no longer regarded as a distinct species.

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V. PTERIDEÆ.

Stipes not articulate to the rhizome; frond at least pinnate, in most species more or less deltoid; sori near the margin, on the ends of the veins, or a strand connecting their ends, protected, except in *Nothochlaena*, by the inflexed and modified margin of the frond.

1. Sorus on inner face of reflexed lobe ..... (35) *Adiantum*
1. Sori on main body of frond, on tips of veins.
    2. Fronds not dimorphous.
        3. Indusium continuous ..... (36) *Doryopteris*
        3. Indusium interrupted.
            4. Sori distinct and solitary ..... (37) *Hypolepis*
            4. Sori more or less confluent ..... (38) *Cheilanthes*
        3. Indusium wanting ..... (39) *Nothochlaena*
    2. Fronds dimorphous ..... (40) *Plagiogyria*
1. Sori on intramarginal strand connecting vein tips.
    2. Extrorse indusium wanting.
        3. Ultimate divisions fine, almost covered by sori ..... (41) *Onychium*
        3. Ultimate divisions more ample.
            4. Lowest pinnules like others ..... (42) *Pteris*
            4. Lowest pinnules stipule-like ..... (43) *Histiopteris*
    2. Extrorse indusium typically present.
        3. Stipe with many vascular strands ..... (44) *Pteridium*
        3. Stipe with one vascular strand ..... (45) *Paesia*

(*Ceratopteris*, a fern growing in brackish or fresh marshes, may be looked for here; it is not in the *Polypodiaceæ*.)

(35) ADIANTUM Linnaeus.

Stipes not articulate to rhizome, usually black and polished; frond, in our species, pinnate to tripinnate, pinnæ inclined to be dimidiate; portions of the margin of the pinnules altered and reflexed, and a sorus borne on the inside of each such portion and protected by it. A natural genus of chiefly terrestrial ferns of most graceful habit, universally cultivated under the name of "maiden-hair."

1. Sporangia springing only from veinlets.
    2. Frond simply pinnate, apex rooting.
        3. Frond glabrous, pinnules stalked.
            4. Rachis not winged ..... (1) *A. philippense*
            4. Rachis winged ..... (2) *A. alatum*
        3. Frond hairy ..... (3) *A. caudatum*
    2. Frond tripinnate ..... (4) *A. Capillus-Veneris*
1. Sporangia on veinlets and parenchyma between them.
    2. Stipe and rachis glabrous ..... (5) *A. diaphanum*
    2. Stipe and rachis squamulose ..... (6) *A. hispidulum*

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(1) **A. philippense** L. Stipes 5 to 20 cm. high, wiry, naked, polished, dark brown; from 15 to 25 cm. long, or the apex more prolonged and rooting, about 5 cm. broad, simply pinnate; pinnæ variable, mostly about 2 cm. long by 1 cm. broad, more or less deciduous from the upper end of a stalk sometimes 15 mm. long, the side toward the rachis forming an obtuse angle with the basiscopic, or sometimes a straight line with it, the upper and outer margins rounded, more or less incised; veins only moderately conspicuous; sori narrower than the lobes they are borne on, and lunulate rather than straight. *A. lunulatum* Burm.

Luzon, *Cuming* 73; Philippines, *Kuhn;* Baguio, *Elmer* 6596; Pangasinan, *Merrill* 281; Lamao Forest Reserve, *Copeland* 397; Manila, *Marave, Topping* 6; Albay, *Baranda.*

Pantropic.

(2) **A. alatum** Copeland. Like the preceding species in size and general appearance; stipe, rachis, and petiolules with a membranous wing 0.5 mm. broad on each side; petiolules rather shorter; inner and lower sides of pinnæ at about a right angle, upper side nearly straight; venation very prominent; sori the width of the lobes bearing them, straight rather than lunulate.

Lamao Forest Reserve, *Copeland* 243, 1399; Culion, *Merrill* 482.

(3) **A. caudatum** L. Stipes tufted, spreading, 3 to 10 cm. long, tomentose; frond 15 to 30 cm. long, usually elongate and rooting at the apex, simply pinnate; pinnæ 10 to 15 mm. long, half as deep, horizontal or ascending, almost sessile, dimidiate, broadest next the base, lower line straight and entire, upper finely incised more deeply than in the preceding species, herbaceous or subcoriaceous, villose; veins prominent, close; sori mostly roundish, on the ends of the lobes.

Luzon, *Cuming* 11; Cagayan-Luzon, *Warburg* 12213; Benguet, *Loher, Elmer* 6403; Nueva Ecija, *Merrill* 278; Bataan Province, *Merrill* 1603, *Barnes Forestry Bureau* 164, *Whitford* 200; Manila, *Loher, Warburg;* Masbate, *Baranda;* Capiz, *Copeland* 55; Mindanao, *Cuming* 292; Davao, *Copeland* 633.

Africa to Malaya.

(4) **A. Capillus-Veneris** L. Stipes about 20 cm. high, black, polished; frond 20 to 40 cm. high, deltoid or narrower; lowest pinnæ themselves sparingly bipinnate; ultimate segments fan-shaped, 10 to 18 mm. deep, with cuneate base and rounded, lobed outer side, membranous, glabrous; sori (in Philippine specimens) decidedly broader than deep.

Benguet, *Elmer* 6417; Mariveles *Loher.*

Southern Europe and Tropics everywhere.

(5) **A. diaphanum** Blume. Stipe 10 to 20 cm. high, slender, blackish, polished; frond 10 to 15 cm. high, 2 to 3 cm. broad and simply pinnate, or usually with 1 to 3 branches at the base, which are sometimes nearly as large as the terminal one; pinnules 1.5 cm. long, half as deep, lower line rather decurved, upper parallel with it and crenate like the outer edge, membranaceous, not quite glabrous; sori round-reniform, in the sinuses of the upper and other margin. Beside the usual mature form, young plants

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with simply pinnate fronds hardly 3 cm. high, on filiform stipes, are sometimes copiously fertile.

Benguet, *Loher, Topping* 225, 280; Lamao Forest Reserve, *Whitford* 266, *Copeland* 1400; Davao, *Copeland* 969, 1113.

China to New Zealand.

(6) **A. hispidulum** Sw. Stipe (in Philippine plants) 3 to 15 cm. high, deciduously squamulous, then scabrous; frond pseudo-pedate, really tripinnate at base, the longer pinnæ ascending together or somewhat divaricate; segments about 1 cm. long, over half as deep, lower ones stalked, lower side entire and straight or curved upward, upper and outer sides sharply toothed, subcoriaceous, not quite glabrous; rachises decidedly hairy; sori round, contiguous around the upper and outer margin; indusium hairy, conspicuously veined. Our plant is not the typical A. hispidulum, but does not seem to me reasonably separable from it.

Mount Mariveles, 1,200 m., *Merrill* 3256, *Copeland* 1390.

Paleotropic.

(36) DORYOPTERIS J. Smith.

Rhizome short, its paleæ costate; stipe black and shining; frond more or less deltoid, simple or pinnate with the pinnæ not articulate to the rachis, opaque; sori terminal, submarginal, in our species fusing laterally and forming a continuous marginal line, protected by the narrow indusium formed by the inflexed margin. A chiefly American genus, represented here by two terrestrial species, readily distinguishable from Pteris by the black stipes.

(1) **D. concolor** (Langsd. & Fisher) Kuhn. Stipe 10 to 15 cm. high, erect, wiry, with a few scales near the base like those on the rhizome; frond triangular, 5 to 10 cm. each way, cut down nearly to the rachis into 3 to 5 pairs of segments, of which the lowest, sometimes distinct pinnæ, are much the largest, and especially deeply cut on the lower side into oblong segments, which in turn are deeply lobed, with margin entire in detail, subcoriaceous, opaque, glabrous or glaucous beneath, greenish above, brown beneath; veins free, invisible, midribs conspicuous, black.

Luzon, *Cuming* (260 ?); Benguet, *Elmer* 6481; Manila, *Loher*.

Pantropic.

(2) **D. ludens** (Wall.) J. Sm. Rhizome slender, creeping; stipe about 10 cm. high, that of fertile frond higher, naked unless at the base; sterile frond variable in shape, ovate-lanceolate or triangular, hastate, deeply cordate or auriculate, sometimes with two or three pairs of lobes, acuminate, with entire or crisped margin, subcoriaceous, glabrous, pale green beneath, dark above; fertile frond deltoid, 15 to 20 cm. high, cut down to a central part 10 to 15 cm. broad into terminal segment and 1 to 3 pairs of lateral ones, of which the lowest are deeply forked, all acuminate, ascending, entire; veins hidden, anastomosing everywhere; fruiting line continuous except at the tips of the segments, narrow.

Luzon, *Cuming* 238; Benguet, *Elmer* 6349; Rizal, *Loher*.

India and Malaya.

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(37) **HYPOLEPIS** Bernhardi.

Rhizome creeping, stipes not articulate to it; fronds at least bipinnate, thin, pubescent; veins free, sori hardly terminal, single in the sinuses, protected by reflexed marginal lobes too small to cover them permanently. Our species is a large terrestrial fern.

(1) **H. tenuifolia** Bernh. Rhizome wide-creeping, densely glandular-puberulent; stipe about 30 cm. high, maroon, shining, puberulous like the rhizome but less so; frond 50 to 250 cm. high, quadripinnatifid; lower pinnæ ovate-lanceolate, 20 to 50 cm. long; pinnules about 10 cm. long, lanceolate; pinnules of second order 2 to 3 cm. long, lanceolate, cut down about to the rachis into linear-oblong, toothed ultimate divisions, herbaceous, sparingly glandular-pubescent beneath, the rachises more so; sori placed in the sinuses of the teeth or ultimate divisions. The resemblance of this species to *Nephrodium rugulosum* is most striking, extending to every detail except the position and protection of the sorus; and in that matter I have specimens of the later species with the sorus nearer the margin than usual, with the tip of the tooth somewhat curled upward, strongly suggesting that these two ferns, apparently representing widely separated groups, may really be the same.

Luzon, *Cuming* 118, 140, 233; Benguet, *Loher;* Lamao River, *Copeland* 233; Mount Apo, *Copeland* 1130, this plant possibly distinct.

Malaya to New Zealand.

(38) **CHEILANTHES** Swartz.

Rhizome short, scaly; fronds at least bipinnatifid; veins free; sori terminal on their thickened ends, usually confluent at maturity, protected at first or permanently by the infolded and modified (membranous) margin of the frond. Terrestrial ferns, chiefly of warm and dry countries.

1. Lower pinnæ smaller than others ..... (1) *C. Boltoni*
1. Lower pinnæ somewhat larger than others.
    2. Frond glabrous, not waxy.
        3. Frond lanceolate, bipinnatifid ..... (2) *C. varians*
        3. Frond deltoid, tripinnatifid ..... (3) *C. tenuifolia*
    2. Frond waxy beneath.
        3. Frond and stipe chaffy ..... (4) *C. rufa*
        3. Frond and stipe not chaffy ..... (5) *C. farinosa*
1. Lowest pinnæ decidedly largest ..... (6) *C. argentea*

(1) **C. Boltoni** Copeland. Stipes densely clustered, 15 to 30 mm. high, brown-black, sparsely clothed with hairs of the same color; frond linear-oblanceolate, larger ones 16 cm. high, 15 mm. broad, bipinnate, broadest two-thirds of the way to the top; pinnæ almost sessile, remote, larger ones 8 mm. long, 6 mm. broad; pinnules 1 to 5 pairs, ovate, minute, crenulate, plane when moist, curling up when dry, glabrous, very thin but firm when dry; indusium interrupted.

Malalag, Davao, on rocks along sea, *Copeland* 616.

(2) **C. varians** Hooker. Stipes densely tufted, 5 to 15 cm. high, chestnut-brown, polished, fibrillose below, slender and brittle; frond 15 to 25 cm.

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high, narrowly lanceolate, bipinnatifid; pinnæ in numerous pairs, lower ones opposite, very remote, 3 cm. long, deltoid-acuminate, cut down to the rachis in the lower part into oblong or linear-oblong entire or slightly toothed lobes, herbaceous, glabrous; sori copious, continuous; indusium narrow.

Luzon, *Cuming* 408.

Himalayas to Malacca and southern China.

(3) **C. tenuifolia** (Burm.) Swartz. Rhizome short-creeping; stipes subtufted, 10 to 20 cm. high, wiry, flexuose, dark brown, polished; frond 10 to 20 cm. high, deltoid, tripinnatifid; pinnæ in numerous opposite pairs, the lowest 5 to 10 cm. long, half as broad, with the largest pinnules on the lower side, the latter pinnules cut down to the rachis into oblong, entire or sinuate-pinnatifid segments, subcoriaceous, glabrous; sori subcontinuous; indusium narrow, brownish, more or less toothed.

Luzon, *Cuming*, 62, 281; Benguet, *Elmer*, stipe and rachis puberulous; Manila, *Loher*, *Warburg;* Culion, *Merrill* 508.

India to New Zealand and Polynesia.

This species sometimes occurs without any indusium, even when very young; judged by its genus-characters it is then a Nothochlaena, but I am unable to separate it specifically: examples are: *Whitford* 536 and *Merrill* 3134, both from the Lamao Forest Reserve.

(4) **C. rufa** Desv. Stipes densely clustered, 4 to 10 cm. high, densely clothed with rusty-brown tomentum; frond 8 to 15 cm. high, ovate-lanceolate, bipinnatifid; pinnæ opposite, the lower remote or not, oblong; pinnules on the lower side the larger, oblong or linear-oblong, crenate, obtuse, both surfaces somewhat tomentose, the lower the more so and beneath the pubescence waxy; sori copious; indusium ragged.

Baguio, *Elmer* 6575.

Himalayas.

(5) **C. farinosa** (Försk.) Kaulf. Stipes densely tufted, 10 to 30 cm. high, erect, dark brown, polished, scaly when young or at the base; frond 15 to 30 cm. high, narrowly ovate, tripinnatifid; pinnæ opposite, the lower pairs the larger, with the longer pinnules on the lower side; largest pinnules deeply pinnatifid into entire, obtuse segments; most pinnæ only pinnatifid, papyraceous or subcoriaceous, glabrous, lower surface covered with white or greenish or brownish waxy powder; sori forming a continuous narrow line along the margin.

Luzon, *Cuming*, 235; Benguet, *Topping* 224, *Elmer* 5889; Arayat and Mariveles, *Loher*. A triangular fern about 5 cm. high on Mount Mariveles is not the next species and may be this.

Pantropic.

(6) **C. argentea** (Gmelin) Hook. Stipes densely tufted, 8 to 15 cm. high, wiry, dark brown, polished, scaly at the base when young; frond triangular, about 8 cm. in diameter, bi- or tripinnate, upper part not cut down to the rachis; lower pinnæ much the largest; cut down nearly to the costa, and the lowest basipetal segment pinnatifid, dark green above, white-waxy beneath; sori very small, fusing.

Benguet, *Loher*.

Siberia to Malacca.

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(39) NOTHOCHLAENA R. Brown.

Stipes clustered; fronds at least pinnate; pinnæ not very inequilateral, not glabrous; sori on the ends of the veins, usually coalescing when old, naked or partly covered by the unmodified margin of the frond. Hardly sufficiently separated from *Cheilanthes* by the modification of the margin of the latter. *C. tenuifolia* has a form with unmodified margin, which will be looked for here. Mostly natives of dry, warm countries.

(1) **N. densa** J. Sm., Hooker. Rhizome creeping, short, scaly; stipe 3 to 12 cm. high, erect, firm, like the rachis, maroon, bearing sparse fibrillose paleæ; frond 10 to 20 cm. high, 2 to 3 cm. broad, tripinnatifid at base; pinnæ ovate-lanceolate, the lowest ones deltoid, remote, equaling or smaller than those next above; pinnules linear-oblong, entire or crenate or pinnatifid, obtuse, herbaceous, slightly hairy above, matted beneath with whitish or brown tomentum; sori at length almost covering the lamina, partly protected at first by the incurved margin.

Corregidor, *Cuming* 282; Benguet, *Elmer* 6384; Mount Mariveles, *Loher*.

(2) **N. distans** R. Br. Stipes densely tufted, about 8 cm. high, bearing linear scales; frond 15 to 20 cm. high, 3 cm. broad, bipinnate; lower pinnæ remote, deltoid, cut down to the rachis into oblong, obtuse, entire or slightly lobed pinnules, subcoriaceous, pale green and slightly villous above, lower surface and rachis more or less densely coated with long, linear, ferruginous scales; pinnæ often much curled together, and the edge incurved.

Mount Mariveles, *Loher*.

Australia, New Zealand, New Caledonia.

(40) PLAGIOGYRIA Kunze.

Stipes clustered, the base abruptly enlarged and bearing 3 to 6 spongy projections on the upper side; fronds dimorphous, simply pinnate; veins free; sori on the somewhat thickened ends of the branched veins, at maturity sometimes covering the contracted frond; sporangium with an oblique continuous annulus; reflexed margin serving at first as an indusium. A small genus of terrestrial ferns, with very much the appearance of *Blechnum-Lomaria*, and sporangia resembling those of the *Cyatheaceæ*.

(1) **P. adnata** (Blume) Bedd. Rhizome short, erect; stipe 15 to 45 cm. high, firm, erect, naked; frond ovate-lanceolate, 30 to 45 cm. high, 10 to 15 cm. broad; pinnæ linear, falcate, the largest about 8 cm. long, 1 cm. broad, the lowest equal to those next above them, narrowed at the base and separated by rather more than their own breadth, those in the middle of the sterile frond widened at the base and contiguous, acuminate, finely serrate, subcoriaceous; rachis naked; indusium brown, membranous, very distinct.

Mount Mariveles, 1,400 m, *Loher*.

India, Japan, Java.

(2) **P. pycnophylla** (Presl) Mett. var. **remota** Chr. Rhizome stout, erect, woody; stipe stout, erect, naked, 15 to 25 cm. high; frond ovate-lanceolate, 60 to 90 cm. high, 15 to 25 cm. broad; pinnæ very numerous, linear,

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spreading, 10 to 15 cm. long, separated by about their own breadth, contracted toward the base, acuminate and finely toothed toward the apex, coriaceous, glabrous, as is true of the other species, except when very young; pinnæ of the fertile frond more distant, short-stalked, with a gland at the base; indusium at first conspicuous, brown.

Mount Data, Lepanto, *Loher*.

India and Malaya (the typical form).

(3) **P. glauca** (Blume) Mett. var. **philippinensis** Christ. Stipe 30 cm. high, naked, erect; frond ovate, 30 to 60 cm. high, 15 to 25 cm. broad; pinnæ separated by as much as their own breadth, linear, erecto-patent, 10 cm. more or less, long, acute, minutely serrulate, contracted to the base, coriaceous; terminal pinna like the lateral; lower surface glaucous; fertile frond similar except that the pinnæ are more distant and narrowly linear.

Mount Data, Lepanto, *Loher*.

India, Java, Celebes (the typical form).

(41) ONYCHIUM Kaulfuss.

Rhizome creeping, chaffy; stipes light colored; frond finely divided, fertile and sterile divisions more or less unlike; veins free except as the tips of the veins of the fertile divisions are connected by an intramarginal strand, on which the sorus is formed; indusium formed by the inflexed margin, broad enough to reach the costa, or nearly so. A small genus, differing from *Pteris* in the finely dissected frond and broad indusium.

(1) **O. japonicum** (Thunb.) Kunze. Rhizome wide-creeping, densely beset with lanceolate-subulate brown paleæ; stipes 15 to 30 cm. high, naked, stramineous or pale brown; frond 20 cm. or more high, ovate, 4- to 5-pinnatifid; pinnæ and pinnules of all orders except the ultimate segments deltoid, with few divisions; ultimate divisions linear-cuneate, about 5 mm. long, trifid at the apex of the sterile segments, the fertile very acute, herbaceous or subcoriaceous, glabrous; sori light brown.

Benguet, *Loher, Topping* 159, 323.

Japan to India and Java.

(2) **O. auratum** Kaulf. Rhizome short, densely scaly; stipes clustered, stout, erect, naked, dull brown, 20 to 30 cm. high, those of the sterile fronds shorter; fronds dimorphous, the sterile 15 to 20 cm. high, the fertile 20 to 30 cm. both ovate, quadripinnate, pinnæ and pinnules mostly deltoid, with few divisions; ultimate segments of sterile frond minute, 3 mm. long, linear-cuneate, trifid or entire, thin-coriaceous, glabrous; segments of fertile frond 10 to 20 mm. long, 1 to 2 mm. broad, entire, cuspidate, given a pod-like appearance by the broad indusia; sori bright golden yellow.

Luzon, *Cuming* 38, *Lobb* 452; Isabela-Luzon, *Warburg* 11605, 12749, 12750; Nueva Ecija, *Merrill* 286; Benguet, *Topping* 173, 216, *Elmer* 5950; Manila, *Chamisso, Loher, Warburg;* Masbate, *Baranda*.

India and Malaya.

(42) PTERIS Linnaeus.

Stipes not black and polished, traversed by a single fibro-vascular bundle; frond at least pinnate, lowest pinnæ usually the most developed, especially

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on the lower side; sorus on a submarginal strand connecting the ends of the veins, wanting in the sinus between the segments, protected by the reflexed and specialized margin, without an extrorse indusium. A genus of terrestrial ferns, most remarkable for the poor definition of the species. Among our species, *P. cretica* and *P. quadriaurita* are especially notable for the number of their more or less distinct forms and related species.

1. Veins free.
  2. Fronds simply pinnate.
    3. Pinnæ cuneate at base ..... (1) *P. opaca*
    3. Pinnæ truncate or cordate ..... (2) *P. longifolia*
  2. Lowest pinnæ forked or pinnate.
    3. Pinnules or segments of lowest pinnæ 1 to 3.
      4. Fronds all equally pinnate.
        5. Sterile fronds serrate.
          6. Stipes pale ..... (3) *P. cretica*
          6. Stipes dark ..... (4) *P. melanocaulon*
        5. Sterile fronds not serrate ..... (5) *P. pellucida*
      4. Sterile fronds more pinnate than the fertile ..... (6) *P. ensiformis*
    3. Segments or pinnules of lowest pinnæ at least 5.
      4. Only lower side pinnatifid ..... (7) *P. semipinnata*
      4. Both sides incised.
        5. Only pinnatifid.
          6. Apex serrate ..... (8) *P. distans*
          6. Apex entire ..... (9) *P. heteromorpha*
        5. Pinnate ..... *P. dispar*
  2. Lower pinnæ at least bipinnatifid.
    3. Lowest pinnæ not greatly enlarged.
      4. Frond not over 1 m. high.
        5. Fronds all alike ..... (10) *P. quadriaurita*
        5. Fronds dimorphous ..... (11) *P. grevilleana*
      4. Frond well over 1 m. high..... (12) *P. excelsa*
    3. Lowest pinnæ greatly enlarged..... (13) *P. longipes*
1. Veins forming areolæ along costa, otherwise free.
  2. Ultimate segments abruptly widened at base..... (14) *P. patens*
  2. Ultimate segments not abruptly widened.
    3. Lowest pinnæ of moderate size.
      4. Margin entire ..... (15) *P. biaurita*
      4. Sterile margin crenate, large fern..... (16) *P. kleiniana*
    3. Lowest pinnæ greatly enlarged ..... (17) *P. wallichiana*
1. Veins more copiously anastomosing ..... (18) *P. tripartita*

(1) **P. opaca** J. Sm. Stipe strong, erect, pale, finely pubescent; frond 60 to 90 cm. high, oblong, simply pinnate; pinnæ in numerous opposite pairs, the largest 30 cm. long, narrowly linear, entire, cuneate at base, coriaceous, glabrous except for the costa beneath; rachis pubescent like the stipe; veins sunk in the frond and only visible as faint striations; indusium narrow, brownish.

Samar or Cebu, *Cuming* 342.

Celebes.

(2) **P. longifolia** L. Stipes clustered, 15 to 30 cm. high, firm, erect, pale, more or less clothed at the base with pale brown scales; frond 30 to 50 cm. high, 10 to 20 cm. broad, attenuate below, simply pinnate; pinnæ sessile, numerous, 10 to 15 cm. long, the lowest reduced, the upper linear,

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acuminate, entire, truncate or cordate or subauricled at the base, subcoriaceous, glabrous; rachis naked or slightly scaly; veins close and fine, usually once forked; indusium membranous, yellowish brown.

Luzon, *Cuming* 6; Cagayan-Luzon, *Warburg* 12214; Benguet, *Loher*, Manila, *Loher, Warburg;* Camarines, Albay, and Catanduanes, *Baranda;* Zamboanga, *Challenger Exp.*

Tropical and warm-temperate lands, everywhere.

(3) **P. cretica** L. Rhizome short-creeping; stipes 15 to 30 cm. high, erect, wiry, naked, polished, pale; frond 15 to 30 cm. high, 10 to 20 cm. broad; pinnæ 2 to 6 pairs, the upper sometimes decurrent, ascending, the fertile narrowly linear, sterile broader, spinulose-serrate, the lowest pair usually cut about to the base into 2 to 3 linear pinnules, subcoriaceous, glabrous; veins fine, close, parallel, simple or forked; indusium membranous, pale.

Rizal, *Loher;* Mount Mariveles, *Merrill* 3122; Masbate, *Baranda;* Davao, *Copeland* 700.

Most warm countries; exceedingly variable.

Pteris stenophylla Hook. and Grev. is a variety with 3 to 5 pinnæ clustered at the apex of the stipe, collected on Corregidor by *Cuming*, No. 283, known also from India.

(4) **P. melanocaulon** Fée. Rhizome erect, small; stipe slender, naked, black, shining, fragile; total height 25 to 30 cm.; frond ovoid, pinnate, with the basal pinnæ forked to the base; pinnæ stalked, linear, arcuate, sterile toward the apex and crenate, acuminate, membranous, glaucous; venation obscure, indusium broad. Treated as a variety of *P. cretica* in Synopsis Filicum.

Isabela-Luzon, *Warburg* 11972; Benguet, *Elmer* 6160 (?); Rizal, *Loher;* Catanduanes, *Baranda;* Jolo Archipelago, *Burbidge;* Davao, *Warburg* 14121.

(5) **P. pellucida** Presl. Stipe 30 cm. or more high, erect, naked, stramineous, frond 30 to 60 cm. high, ovate-lanceolate, simply pinnate, or the lowest pinnæ forked; pinnæ 3 to 6 pairs, sessile, linear, entire or serrulate toward the point, upper ones slightly decurrent, coriaceous, bright green, often glossy; veins conspicuous, fine, close, simple or forked; indusium membranous, brownish.

Luzon, *Haenke, Cuming* 85; Benguet, *Loher. Merrill's* No. 3772, from the Lamao Forest Reserve, may be this or a form of *P. longifolia* with the lowest pinnæ forked.

Guinea, India, Malaya.

(6) **P. ensiformis** Burman. Rhizome short, creeping; stipe of sterile frond 5 to 10 cm. high, of fertile, 10 to 30 cm. slender, erect, naked, stramineous; sterile from 10 to 15 cm. high, 3 to 8 cm. broad, bipinnatifid or bipinnate, the segments with rounded, dentate apex, obovate, about 10 mm. long; fertile frond 20 to 30 cm. high, pinnate; pinnæ entire or the lower pinnatifid, 8 to 15 cm. long, linear, sterile apex serrate, upper ones adnate at base, herbaceous, glabrous; veins usually forked, not conspicuous. Exceedingly variable.

Luzon, *Cuming* 45, 46; Manila *Loher, Warburg* 12745, *Marave;* Mindoro,

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Merrill 3347; Masbate and Bataan, *Baranda;* Capiz, *Copeland* 56; Davao, *Copeland* 375.

India to Polynesia.

(7) **P. semipinnata** L. Stipe about 30 cm. high, firm, erect, naked, bright chestnut brown; frond about 30 cm. high, half as broad, ovate-lanceolate, the upper part cut down to the rachis into close entire lobes, the lower two-thirds with 6 to 8 pairs of opposite distantly-placed pinnæ; pinnæ with long, entire points, and a broad entire wing on the upper side, but the lower side with several linear pinnules, sterile margins finely serrate, subcoriaceous, glabrous; veins simple or once forked; indusium membranous.

Luzon, *Cuming* 258. *Merrill's* No. 3790, from the Lamao Forest Reserve, differs only in that all the divisions are shorter, and proportionally broader.

India to Japan and Borneo.

(8) **P. distans** J. Sm. Stipe about 15 cm. high, slender, erect, naked, pale; frond about 30 cm. high, 10 to 15 cm. broad, upper part long, linear, sharply serrate, below this 12 to 20 pairs of close short lobes, the lower two-thirds of the frond with 6 to 9 pairs of opposite, distant, linear-pointed pinnæ; each with a few spreading pinnules at its base, coriaceous; rachis scabrous; veins conspicuous, simple or once forked; sterile lobes finely spinulose-serrate; indusium membranous.

Luzon, *Cuming* 410.

(9) **P. heteromorpha** Fée. Stipe 15 to 30 cm. high, naked, erect, pale; frond 30 to 45 cm. high, half as broad, ovate-lanceolate, the upper part with a long entire terminal point, below which it is sinuate and furnished with a few short, linear lobes; pinnæ in several opposite pairs, the lowest of which are 1 dm. apart, the upper ones entire or slightly compound at the base, the lowest pair cut down nearly to the rachis, with several spreading linear pinnules on each side, subcoriaceous, glabrous, the margins slightly crisped; veins conspicuous, usually once forked; indusium narrow, membranous.

Luzon, *Cuming* 409; Rizal and Manila, *Loher.*

Celebes.

P. dispar Kunze is a fern differing from *P. semipinnata* only in that the upper side of the pinnæ as well as the lower, is more or less pinnate; tney are hardly specifically distinct.

Isabela-Luzon, *Warburg* 11613.

China and Japan.

(10) **P. quadriaurita** Retz. Stipe 30 to 60 cm. high, strong, erect, naked or slightly scabrous, stramineous or brownish; frond varying from 15 to 100 cm. in height, 10 to 30 cm. or more broad, with a terminal, central pinna cut down nearly to the rachis into numerous, close, parallel linear-oblong lobes 1 to 2 cm. long, 4 to 6 mm. broad, the sterile ones entire or slightly serrate; lateral pinnæ several pairs, 15 to 30 cm. long, 2 to 5 cm. broad, the lowest ones usually again compound, having 1 or 2 similar but smaller pinnules branching from the base on the lower side, all cleft to the rachis into close, erecto-patent, entire, linear or linear-oblong segments;

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veins conspicuous, usually once forked; sori often continuous along the whole margin of the segments.

Luzon, *Cuming* 69, 79; Isabela-Luzon, *Warburg* 11612; Nueva Vizcaya, *Merrill* 234; Benguet, *Topping* 287, *Elmer* 5619, 6213; Arayat, *Loher, Merrill* 3813, puberulous; Lamao River, *Copeland* 239; Manila, *Warburg, Merrill* 642; Camarines and Masbate, *Baranda;* Jolo Archipelago, *Burbidge;* Davao, *Warburg* 14120, *DeVore* and *Hoover* 254, *Copeland* 667. We have many more specimens very near this.

All warm countries.

P. quadriaurita var. **setigera** Hooker is a form with fine, spine-like scales on the rachises and main veins, at least on the dorsal surface, and usually more linear segments.

Luzon, *Cuming* 253,413; Cagayan-Luzon, *Warburg* 12215; Arayat, *Merrill* 3814; Rizal, *Loher;* Basilan, *DeVore* and *Hoover* 93.

India, Hongkong.

(11) **P. grevilleana** Wall. "Dimorphic, barren stipe shorter, winged toward the apex; barren frond pedately 5-fid, scarcely pinnate, margin spinulose-serrate; fertile frond with 5 pinnæ, the lower pair bipartite, veins exceedingly obscure. Suspiciously like P. quadriaurita, except that the fronds are dimorphic."

Benguet and Rizal, *Loher.*

India.

(12) **P. excelsa,** Gaud. Stipe thick, erect, naked, glossy, pale brown; frond nearly 2 m. high, sometimes more; terminal pinna 30 cm. or more long, 8 cm. broad, with numerous close, falcate, linear lobes on each side, which are sometimes more than 5 cm. long, hardly 1 cm. broad, narrowly obliquely decurrent, and slightly serrate where sterile; lateral pinnæ several, similar to the terminal one, the lowest remote, sometimes bipartite, subcoriaceous, glabrous; veins once forked; sori not reaching the apex of the segments.

Philippines, *Gaudichaud.*

Himalayas, Hawaii.

(13) **P. longipes** Don. Stipe 30 to 60 cm. high, erect naked, stramineous; terminal pnina about 15 cm. high, linear, cleft to the rachis into numerous erecto-patent, linear-oblong lobes which are obtusely toothed toward the point when sterile; lateral pinnæ numerous, close, the longest simple ones about 15 cm. long, the lowest pair compound, sometimes nearly as large as the whole of the rest of the frond, 30 cm. long, 15 cm. broad, herbaceous, glabrous; veins not prominent, forked; sori falling short of the apex of the segments. Costa of pinnules sometimes spinulose on the upper side.

Luzon, *Cuming* 8; Masbate, *Baranda.*

India to New Guinea.

(14) **P. patens** Hooker. Stipe 30 cm. or more high, erect, naked glossy, chestnut brown; frond ample, 1 m. high, 60 cm. or more broad; terminal pinna 15 to 25 cm. long, 4 to 5 cm. broad, with several linear lobes on each side, which are widened suddenly near the base on each side, the sterile ones slightly serrate; lateral pinnæ numerous, similar but larger, some-

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times 45 cm. long, 5 cm. broad, the lowest forked, scarcely coriaceous, glabrous; veins oblique, not conspicuous, usually forked, sori reaching nearly to the end of the segment. I am sceptical as to the anastomosing of the veins.

Luzon, *Cuming* 103; Davao, *Warburg* 14123.

Himalayas to Japan and Polynesia.

(15) **P. biaurita** L. Stipe 30 to 60 cm. high, strong, erect, naked, stramineous; frond with a terminal pinna 15 to 30 cm. long, 3 to 5 cm. broad, cut down within about 5 mm. of the rachis into numerous spreading linear-oblong lobes; lateral pinnæ several pairs, similar to the terminal one, the lowest rather remote and usually once forked, segments entire, obtuse, papyraceous or subcoriaceous, glabrous; veins evident, forming single areolæ along the costa of the pinna but entirely free in the segments.

Rizal, *Marave* 130.

Pantropic.

P. armata Presl. "Fronds cordate-ovate glabrous glaucescent pinnate, pinnæ opposite sessile pinnatifid lowest ones bipartite, segments linear obtuse entire unequal, terminal one elongate, repand, secondary rachises and costa above spinose, stipes smooth." This is probably *P. quadriaurita* var, *setigera*, fitting perfectly with the plant from Arayat.

Sorsogon, *Haenke*.

(16) **P. kleiniana** Presl. Total height 2 m.; frond pedately ovate, pinnate; pinnæ broadly lanceolate, long-caudate, deeply pinnatifid into subfalcate segments, crenate where sterile, submembranaceous; sori falling well short of the apex of the segments; otherwise like *P. biaurita*, with which Hooker and Baker unite it.

Cagayan-Luzon, *Warburg* 11617, 12202.

India.

(17) **P. wallichiana** Agardh. Stipe about 15 cm. high, strong, naked, glossy, bright chestnut brown; frond tripartite with lateral divisions again forked, the central often 60 cm. long, 30 cm. broad, with numerous lanceolate, sessile, opposite pinnules, the largest of which are 15 cm. long, 2 cm. broad, cut down within about 2 mm. of the costa into numerous contiguous linear-oblong lobes, the sterile ones nearly entire, herbaceous, glabrous; lateral pinnæ nearly as large as the terminal one; veins not conspicuous, forming single areolæ along the costa between the main veins, rarely another areola at the base of the main vein; sori continuous along nearly the entire margin.

Luzon, *Cuming* 204, *Lobb* 481.

Himalayas to Samoa.

(18) **P. tripartita** Sw. Stipe 30 to 100 cm. or more high, strong, erect, naked, polished, stramineous or brownish, like the rachises; frond tripartite, the central part 60 cm. or more long; terminal pinna 15 to 25 cm. long, 15 to 30 mm. broad, cut deeply into numerous close, linear or oblong lobes, which are subfalcate and slightly toothed where sterile, herbaceous, glabrous; lateral pinnæ numerous, close, all unbranched; lateral divisions similar, but shorter and usually branched; veins fine, anastomosing chiefly along the costa and main veins, sori not reaching the apices of the segments.

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Luzon, *Cuming* 41, 204; Isabela-Luzon, *Warburg* 11616; Benguet, *Loher, Elmer* 6028; Lamao River, *Copeland* 242; Rizal, *Ramos;* Laguna, *Loher;* Mindoro, *Merrill* 877; Masbate (?), *Baranda;* Paragua, *Merrill* 824a; Tropics, Africa across Polynesia.

(43) HISTIOPTERIS Agardh.

Rhizome wide-creeping; stipe polished, stramineous to purplish; frond bi-quadripinnatifid, lowest pinnules usually stipule-like; sori as in Pteris, but commonly continuous around the sinus, and the spores bilateral instead of tetrahedral. A genus of pantropic terrestrial ferns, usually all reduced to a single species.

(1) **H. incisa** (Thunb.) Agardh. Entire height commonly 2 m.; stipe stout, erect, sometimes muricate toward the base; frond ovate or narrower, bi-tripinnate; uppermost pinnæ with entire oblong or linear-oblong pinnules; those next below with numerous long, pinnatifid pinnules, the lowest of which are close to the rachis and often adnate to it; lowest pinnæ often very large, and quadripinnatifid, herbaceous or subcoriaceous, glabrous or glaucous beneath; veins anastomosing to form several series of areolæ, free near the margin; sori interrupted, or continuous around the sinuses and apices of the segments.

Luzon, *Cuming* 192; Baguio, *Topping* 239, *Elmer* 6007; Mount Mariveles. Tropics and farther south.

(2) **H. montana** Copeland. Rhizome beset with minute, brown paleæ; stipe firm, 10 to 20 cm. high; frond 15 to 30 cm. high, often broader than high, bi-tripinnatifid, lowest pinnæ slightly larger than succeeding, very coriaceous; veins prominent, raised above upper surface; indusia broad, margin everywhere rolled in, giving segments a lomarioid appearance.

Mount Apo, above 2,500 m.; *DeVore* and *Hoover* 332, *Copeland* 1049.

(44) PTERIDIUM Gleditsch.

Rhizome creeping, scaly; stipe with many fibro-vascular bundles; frond at least bipinnate, deltoid; sorus on an intramarginal strand connecting the ends of the veins, covered by an extrorse indusium, and this by the inflexed margin of the frond; spores tetrahedral. A single polymorphous species.

(1) **P. aquilinum** (L.) Kuhn. Rhizome stout, wide-creeping, underground; stipe 30 cm. or more high, strong, erect, naked, stramineous or light brown; frond 60 to 100 cm. or more high, 30 to 60 cm. broad; uppermost pinnæ simple, the next pinnatifid, then pinnate; the lowest the largest, bipinnatifid or tripinnatifid, coriaceous, glabrous.

Lepanto and Benguet, *Loher.*

Cosmopolitan, chiefly northern.

P. aquilinum var. **lanuginosum** Bory. Fronds evidently pubescent or silky-tomentose beneath; pinnules more generally and regularly pinnatifid.

Luzon, *Cuming* 24, 100; Bohol, *Cuming* 353.

Cosmopolitan, chiefly tropical.

Topping, No. 242, from Baguio is a mixture, perhaps including both forms of this species.

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(45) **PAESIA** St. Hilaire.

Rhizome creeping; stipe with a single horseshoe-shaped fibro-vascular bundle; otherwise like Pteridium, except that the extrorse indusium is sometimes wanting, and the spores are bilateral.

(1) **P. rugulosa** (LaB.) Kuhn. Stipe and rachises slender, glutinous-pubescent, castaneous; frond quadripinnatifid, rhomboidal; pinnæ close, erecto-patent, under 30 cm. long; pinnules close, lanceolate, nearly sessile, 1 cm. broad; segments lanceolate, cuneate-truncate on lower side at base, the lower deeply pinnatifid with oblique blunt lobes, subcoriaceous, glutinous and minutely furfuraceous especially below, dull green; sterile segment serrate, fertile with revolute margin, the sorus reaching to the costa.

Mount Data, Lepanto, in pine forest, *Loher*.

New Caledonia, Otaheite (?).

I do not know this fern, but find nothing in the descriptions to indicate that it has an extrorse indusium; its aspect must be that of *Hypolepis*, to which it was assigned by Hooker.

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VI. VITTARIEÆ.

Fronds simple and entire, not articulate to the rhizome; veins free or anastomosing without free included veinlets; sori marginal or dorsal, linear, usually immersed. Small ferns, mostly epiphytic.

1. Sori single, lines parallel to the costa, fronds grass-like.
   2. Sori on or near the costa ..... (46) *Monogramme*
   2. Sori in or near the margin ..... (47) *Vittaria*
1. Sori following the veins and anastomosing with them, fronds broader ..... (48) *Antrophyum*

(46) **MONOGRAMME** Schkuhr.

Rhizome creeping; fronds (in our species) scattered, small, linear, without other veins than the costa, glabrous; sorus on or near the costa, usually protected by an outgrowth of leaf-tissue. Exceedingly simple epiphytes.

1. Sori on the costa ..... (1) *M. trichoidea*
1. Sori beside the costa.
   2. Outgrowth of tissue on both sides of costa ..... (2) *M. paradoxa*
   2. Outgrowth of tissue on one side of costa ..... (3) *M. dareaecarpa*

(1) **M. trichoidea** J. Sm. Rhizome slender; fronds numerous, filiform, 10 cm. or less long; the fertile ones dilated in two or three places, and there bearing the sori, with high-raised edges on each side.

Luzon, *Cuming* 160.

(2) **M. paradoxa** (Fee) Bedd. Rhizome creeping, scaly; fronds forming a turf, 5 to 30 cm. long, 1 mm. broad, flaccid, herbaceous; sori sunk in a furrow on one or both sides of the costa.

Philippines, according to Synopsis Filicum.

Ceylon to Hawaii and Australia.

(3) **M. dareaecarpa** Hooker. Rhizome clothed with minute, narrow, brown scales; fronds forming a turf on living trees, about 2 cm. high, hardly 1 mm. broad near the top, subacute, narrowed downward but without a distinct petiole, the fertile taller and relatively more slender than the sterile, often notched at the apex by the projection of the pseudo-indusium; sorus along one side of the costa, covered by an outgrowth from it reaching almost to the margin, confined to the apex of the frond, not more than 3 mm. long.

Gimogon River, Negros, *Copeland* 63.

Labuan, New Guinea (?).

The Negros plant differs from the type in the absence of a distinct stipe, and the very short sorus.

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(47) **VITTARIA** Smith.

Rhizome creeping; fronds grass-like, more or less tufted; veins free; sori in continuous marginal or intramarginal lines. Epiphytes in moist forests, very common. There is no genus of ferns whose species are more difficult of determination. The following list by no means exhausts the Philippine species; but includes all of whose identity and distinctness I feel certain.

1. Sorus in a two-lipped marginal groove ..... (1) *V. elongata*
1. Sorus a slightly intramarginal line, with the margin rolled back over it at first.
   2. Sorus narrow, fronds thick.
      3. Sori subimmersed ..... (2) *V. lineata*
      3. Sori immersed ..... (3) *V. falcata*
   2. Sorus broad, fronds thin ..... (4) *V. scolopendrina*

(1) **V. elongata** Sw. Fronds 15 to 60 cm. long, seldom 1 cm. broad, acute or obtuse, coriaceous; veins simple, oblique, immersed, parallel, connected by the intramarginal soriferous veinlet; sori quite sunk in a marginal groove with two nearly equal lips opening outward. As defined here, this species includes *V. ensiformis* Sw., collected in Luzon by *Cuming*, nos. 28 and 76, and several other rather diverse forms.

Malanipa, Zamboanga, *Challenger Exp.;* Jolo Archipelago, *Burbidge;* Benguet and Rizal, *Loher;* Mount Mariveles, *Copeland* 1401; Mount Apo, *Copeland* 992.

Tropics of Eastern Hemisphere.

(2) **V. lineata** Sw. Frond 15 to 50 cm. long, less than 1 cm. broad, attenuate below, passing insensibly into the stipe, coriaceous; costa reaching the apex, veins immersed, parallel, oblique; sorus intramarginal in a shallow groove, protected when young by the margin of the frond.

Benguet, *Loher, Topping* 219, *Elmer* 6125, 6277; Mount Arayat, *Loher, Merrill;* Mount Mariveles, *Copeland* 221, 222; southern Luzon, *Baranda;* Negros, *Copeland* 57.

Pantropic.

V. lineata, var. **trichoides** Christ. Differs from the typical form in having fronds only one-half mm. broad, and the margin so folded over the sorus that it may scarcely appear.

Davao, *Warburg* 14151.

(3) **V. falcata** Kunze. Frond 10 to 15 cm. long, 3 mm. broad, obtuse, narrowed gradually to the base, very thick; costa reaching the apex of the sterile but not of the fertile fronds, veins short, oblique, parallel, immersed; sori quite sunk in slightly intramarginal grooves. *V. minor* Fée is a smaller fern included here.

Rizal, *Loher.*

Malaya.

(4) **V. scolopendrina** Mett. Fronds 30 to 50 cm. long, 1 to 2 cm. broad, acute, contracted gradually to the base, coriaceous, but not exceedingly thick; costa thick, veins fine, oblique, simple; sorus in a rather broad submarginal groove protruding slightly from the upper surface, protected at first by the margin.

Catanduanes, *Baranda;* Davao, *Warburg* 14152.

Paleotropic.

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(48) ANTROPHYUM Kaulfuss.

Rhizome short, creeping, clothed with copious very narrow brown paleæ; fronds clustered, simple, entire, rather thick; veins anastomosing, without free included veinlets; sori along the veins, in general lengthwise of the leaf and anastomosing with the veins. Aside from *Vittaria*, the nearest relatives of *Antrophyum* in our flora are *Loxogramme*, treated by Blume as a section of it, and *Hemionitis*, under which the first species were described. The species are variable, and not at all sharply distinguishable.

1. Stipe long (10 cm.) ..... (1) *A. plantagineum*
1. Stipe short or none.
    2. Costa reaching half way up the frond..... (2) *A. semicostatum*
    2. Costa disappearing near base of frond.
        3. Apex broadly rounded ..... (3) *A. obtusum*
        3. Apex obtuse or acute.
            4. Frond broad, sori free..... (4) *A. callaefolium*
            4. Narrow or sori anastomosing.
                5. Frond very thick ..... (5) *A. coriaceum*
                5. Frond only moderately coriaceous.
                    6. Frond small (15 cm.), stipitate, sori free ..... (6) *A. parvulum*
                    6. Frond larger, sori usually anastomosing ..... (7) *A. reticulatum*

(1) **A. plantagineum** Kaulf. Stipes stout, glabrous, about 10 cm. high; fronds 10 to 20 cm. long, one-third as broad, broadest above the middle, acute at both ends, very fleshy when fresh; costa wanting but median line of frond sterile; sori copious, deeply immersed, anastomosing somewhat.

Rizal, *Loher;* southern Luzon, *Baranda;* Davao, *Copeland* 632.

India across Polynesia.

(2) **A. semicostatum** Blume. Frond 15 to 40 cm. high, 5 to 8 cm. broad, broadest near the apex, narrowed abruptly to the acute apex, and gradually to the base or short stipe; costa blackish, visible half way up the frond; sori copious, anastomosing freely, rising above the surface.

Sorsogon and Catanduanes, *Baranda.*

Ceylon across Polynesia.

(3) **A. obtusum** Kaulf. Fronds 2 to 6 cm. high, spatulate, gradually contracted from the broad, rounded apex to a short stipe, thin-coriaceous, very young fronds black-hairy; costa entirely wanting; sori in grooves but rising well above surface, forking, and sometimes anastomosing.

Davao, *Copeland* 845, 931; Paragua, *Merrill* 786.

Bourbon, Java.

(4) **A. callaefolium** Blume. Fronds 15 to 30 cm. high, 4 to 8 cm. broad, "spatulate-lanceolate," abruptly contracted to the acuminate or obtuse apex, gradually to a base decurrent on a short stipe, coriaceous; costa wanting; sori free, rather straight.

Rizal, *Loher;* Davao, *Warburg* 14161, *DeVore* and *Hoover* 277, *Copeland* 1253.

Java, Celebes.

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(5) **A. coriaceum** Wall. Fronds 15 to 20 cm. high, 1 to 2 cm. broad, narrowed gradually from the middle to the acute apex and usually sessile base, very thick; costa wanting; sori entirely immersed, confluent or not.

Los Baños, *Loher*.

Himalayas, southern China, Malaya.

(6) **A. parvulum** Blume. Fronds 10 to 20 cm. high, 1 to 2 cm. broad, attenuate from the middle to the acute apex and short stipe; costa wanting; sori rather sparse and straight, in grooves, mostly free.

Mount Apo, *Copeland* 1117.

Java.

(7) **A. reticulatum** Kaulf. Fronds 15 to 50 cm. high, mostly about one-tenth as broad, exceedingly variable, broadest in the middle or near the apex, gradually or abruptly contracted to an acuminate or merely subacute apex, attenuate below to a sessile base, or (in Philippine specimens) short stalk, thin-coriaceous; costa black or green, usually visible for a few centimeters into the frond, sometimes wanting, venation very evident; sori usually copious and anastomosing, rarely sparse, or even reduced to two lines on each half of the lamina. This is our commonest *Antrophyum*, and in one or another of its forms approaches almost all the other species. Our commonest form is *A. falcatum* Bl., which is shorter-stalked than the type, but not really distinguishable. *A. Cumingii* Fee, *Cuming* 416, also collected in southern Luzon by *Baranda*, is likewise inseparable from it.

Benguet, *Elmer* 6126; Mount Arayat, *Loher;* Mount Mariveles, *Merrill* 2540, *Copeland* 210, 211; Rizal, *Merrill* 2665; Davao, *Copeland* 974; Jolo Archipelago *Burbidge*.

India across Polynesia.

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VII. POLYPODIEÆ.

Stipes articulate to the rhizome; indusium wanting. The fronds are simple or variously cut, the pinnæ as a rule equilateral; veins free or variously anastomosing; sori terminal or dorsal on them, usually of definite form and size, superficial or less often sunken.

1. Sori linear, parallel to the midrib, sometimes spreading over the parenchyma (*Taenitidæ*).
    2. Sori on sharply differentiated apex of frond ..... (49) *Hymenolepis*
    2. Sori not confined to a specialized apex.
        3. Fronds pinnate, stipes not articulate to rhizome.... (50) *Taenitis*
        3. Fertile fronds trident-shaped ..... (51) *Christopteris*
        3. Fronds entire ..... (52) *Drymoglossum*
1. Sori usually round, sometimes elongate but not along costa.
    2. Fronds with stellate pubescence, fronds simple..... (53) *Niphobolus*
    2. Fronds naked, or pubescence not stellate.
        3. No distinct brown basal fronds.
            4. Sori definite, not spreading over parenchyma.
                5. Sori dorsal ..... (54) *Polypodium*
                5. Sori in reflexed outgrowths of margin.. (55) *Lecanopteris*
            4. Sori spreading over parenchyma, confined to apical segments of frond.
                5. Frond pinnate ..... (56) *Photinopteris*
                5. Frond pinnatifid ..... (57) *Dryostachyum*
        3. Dimorphous, basal fronds brown and rigid..... (58) *Drynaria*

(49) HYMENOLEPIS Kaulfuss.

Rhizome stout, creeping, scaly; fronds simple, entire or repand, contracted to a sharply differentiated fertile apex; no distinct sori in the fertile region; veins anastomosing, with free included veinlets. Small or moderate sized ferns.

(1) **H. spicata** (L. f.) Presl. (Including *H. revoluta* Bl. and *H. ophioglossoides* Bl.). Rhizome creeping, scaly; stipe 2 to 4 cm. high, glabrous, stramineous or the base ebeneous; sterile part of frond 15 to 40 cm. high, one-tenth as broad, entire, attenuate to both ends, or more abruptly contracted above, glabrous, herbaceous or coriaceous, flat or carinate; fertile part narrowly linear, 5 to 25 cm. long, decurved. Epiphytic.

Luzon, *Meyen, Cuming* 92; Benguet, *Loher, Barnes Forestry Bureau* 961; Mount Arayat, *Loher, Merrill;* Mount Mariveles, *Copeland* 213; Mount Apo, *Copeland* 1001 (very small), 1026.

Madagascar to southern China and Polynesia.

(2) **H. platyrhynchos** (J. Sm.) Kunze. (*Macroplethus* Presl.) Rhizome very short, scaly; fronds clustered, attenuate to almost sessile bases,

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sterile part about 25 cm. high, more than one-fifth as broad, margin wavy, both surfaces glabrous, coriaceous; fertile segment about 5 cm. high, more than one-fourth as broad, obtuse, with a broad laminal wing on both sides of the fertile area. Terrestrial or epiphytic.

Luzon, *Cuming* 196, *Steere;* Benguet, *Elmer, Barnes* 960; Mount Arayat 800 m., *Loher.*

Celebes.

(50) **TAENITIS** Willdenow.

Rhizome creeping, hairy; stipes not articulate to it; fronds simply pinnate; veins anastomosing, without free included veinlets; sori linear, about midway between margin and costa, usually uninterrupted. Terrestrial ferns of moderate size. Not very evidently related to its neighbors here, and perhaps better transferred with *Platytaenia* to the neighborhood of Gymnopteris.

(1) **T. blechnoides** Swartz. Stipe 20 to 40 cm. high, fibrillose at base, glabrous above, brown or maroon; frond 20 to 50 cm. high; pinnæ 3 to 6 pairs, 15 to 25 cm. long, linear-lanceolate, entire, acute at both ends, sessile or short-stalked, glabrous, coriaceous, bright green above, brownish below; sori rather nearer the margin than the costa.

Sorsogon, *Baranda;* Negros, *Copeland* 71; Guimaras, *Cuming* 277; Paragua, *Merrill* 719.

Ceylon to Malaya.

Platytaenia requiniana (Gaud.) Kuhn is a fern very like *Taenitis* in its vegetative characters, but with the entire back of the contracted fertile frond covered by sporangia. From the meager descriptions it seems likely to me that it is a *Gymnopteris,* but Diels places it next to *Taenitis.*

Philippines, Née.

Moluccas to New Hebrides.

(51) **CHRISTOPTERIS** Copeland.

Rhizome creeping, scaly; fronds dimorphous, the sterile triangular, ample, the fertile tripartite into linear segments; veins anastomosing with free included veinlets; sori parallel and close to the costa, linear, finally covering the whole surface. Epiphytic.

C. Sagitta (Christ) Copeland. Rhizome creeping or scandent, the young part densely beset with spreading cinnamon-colored hairs about 8 mm. long, which are deciduous, leaving older parts sparsely clothed with ferruginous scales about 4 mm. long; stipes fuscous or ebeneous, of sterile frond about 10 cm., of fertile about 20 cm. high, glabrous; sterile frond triangular, 15 to 20 cm. high, and broad, the points acuminate, with a triangular sinus 2 cm. high and wide where the stipe is attached, and broad shallow ones between the lateral points and the apex, glabrous, coriaceous; the 3 main ribs conspicuous, their branches strictly parallel, subevident; fertile frond cleft to within 1 cm. of the base into 3 narrowly linear somewhat spreading obtuse segments 8 to 20 cm. long, 3 mm. broad.

Benguet, *Loher;* Mount Mariveles, *Copeland, Whitford* 321; *Borden Forestry Bureau* 1339.

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(52) DRYMOGLOSSUM Presl.

Rhizome creeping; fronds simple and entire, dimorphous; veins anastomosing; sori linear, parallel to the costa, mixed with peltate scales. Small epiphytic ferns, with apparent affinity to Niphobolus, from which they are distinguished by the form of the sorus.

1. Sorus remote from margin (*Lemmaphyllum* Presl).
   2. Apex very obtuse ..... (1) *D. spatulatum*
   2. Apex subacute ..... (2) *D. carnosum*
1. Sorus marginal ..... (3) *D. piloselloides*

(1) **D. spatulatum** Presl, Tent. Pterid. p. 227. Sterile frond elliptic-lanceolate, obtuse, with acute base, fertile linear-spatulate, very obtuse, with stipe 1 cm. long; sorus continuous but confined to the upper half of the frond.

Manila, *Meyen.*

This species is distinguished from *D. carnosum* Hooker by the stipitate but not decurrent, very obtuse fertile frond, and restriction of the sori to its upper half: as the last character often marks a stage in development, and *D. carnosum* is more or less stalked, *D. spatulatum* is a doubtfully distinct species. There is no other record of any form of *D. carnosum* from the Philippines, until the discovery of the following.

(2) **D. carnosum** Hooker. Rhizome wide-creeping, slender, sparsely scaly; the sterile frond 5 to 6 cm. long, on a stipe 1 to 2.5 cm. long, rather obtuse, the fertile fronds linear-spatulate, about 5 cm. long, 6 mm. broad, on a stipe 3 to 4.5 cm. long, subacute, attenuate to the stipe; texture coriaceous; areolæ large, with few free usually hamate veinlets; sori nearer the midrib than the margin.

Mount Santo Tomas, Benguet, *Elmer* 6562.

Himalayas, Formosa, Amboyna.

(3) **D. piloselloides** Presl. Rhizome firm, wide-creeping, with black roots; sterile fronds obovate-elliptical 2 to 3 cm. long, 12 to 15 mm. broad, fertile ones linear-oblong, 5 to 10 cm. long, 4 to 5 mm. broad, both narrowed to a short stem, coriaceous; veins immersed, with copious free included veinlets; sori in a broad continuous submarginal line.

Luzon, *Cuming* 115, *Steere;* large long-stipitate sterile fronds collected by *Loher* on Tonglon are ascribed by Christ to this species; Davao, *Copeland* 349.

India to Celebes.

(53) NIPHOBOLUS Kaulfuss.

Rhizome creeping; fronds simple, almost always entire, coriaceous, with stellate pubescence; veins anastomosing, with free included veinlets. Small epiphytes, recognizable superficially by the narrow, rigid fronds.

1. Areolæ regular, with included veinlets running toward margin.
   2. Fronds not, or but slightly, dimorphous.
      3. Lower surface loosely and copiously woolly.
         4. Frond 2 to 3 cm. broad..... (1) *N. fissus*
         4. Frond about 1 cm. broad..... (2) *N. flocciger*

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3. Lower surface appressed—woolly.
4. Veins hidden ..... (3) *N. achrostichoides*
4. Veins evident ..... (4) *N. Lingua*
3. Lower surface very sparsely pubescent.
4. Veins evident ..... (5) *N. sphaerostichum*
4. Veins hidden ..... (6) *N. varius*
2. Fronds decidedly dimorphous.
3. Sterile frond nearly glabrous, spatulate.... (7) *N. adnascens*
3. Sterile frond orbicular, very woolly..... (8) *N. nummulariaefolius*
1. Areolæ irregular, with included veinlets in various directions.
2. Stipe 2 to 10 cm. high.
3. Paleæ of rhizome linear, entire..... (9) *N. samarensis*
3. Paleæ of rhizome ovate, serrulate..... (10) *N. angustatus*
2. Frond sessile ..... (11) *N. splendens*

(1) **N. fissus** Blume. Rhizome stout, short-creeping, clothed with squarrose, lanceolate-acuminate ferruginous scales; fronds sessile or nearly so, 15 to 30 cm. high, 15 to 35 mm. broad, narrowed very gradually to both ends, entire, subcoriaceous, upper surface naked, lower densely coated with soft woolly, ferruginous tomentum; veins invisible; sori close, scattered, immersed among the tomentum.

Benguet, *Loher*.

India, Java.

(2) **N. floccigер** Blume. Rhizome wide-creeping clothed with squarrose lanceolate-acuminate scales which are ferruginous when young, turning white; stipes 30 to 45 mm. high, floccose-woolly; fronds 20 to 30 cm. high, 6 to 10 mm. broad, acute, attenuate to base, entire, rigidly coriaceous, upper surface naked, lower densely matted with whitish or subferruginous tomentum; veins invisible; sori immersed among the tomentum, covering the upper part of the frond.

Luzon, *Cuming* 93; Sorsogon, *Baranda;* Mount Arayat, *Merrill* 3820; Mount Mariveles, *Whitford* 312.

India, Java.

(3) **N. achrostichoides** (Forst.) J. Sm. Rhizome woody, wide-creeping clothed with roundish or elliptical scales, black except at the margin; stipes about 5 cm. high, stout, erect, glabrous or nearly so, conical at base and inserted into the branch of the rhizome specialized to bear it; frond 30 to 40 cm. high, 10 to 15 mm. broad, attenuate to both ends, entire, rigidly coriaceous, upper surface naked, lower with a closely appressed whitish tomentum; veins invisible; sori distinct but contiguous, usually covering rather more than the upper half of the frond.

Luzon, *Cuming* (88 =*Cyclophorus blumeanus* Presl ?) 127; Los Baños, *Loher;* Negros, *Copeland;* Davao, *Copeland.*

Ceylon to the New Hebrides and Queensland.

(4) **N. Lingua** (Thunb.) J. Sm. (The Philippine form, described here is *Polypodium heteractis* Mett. and Kuhn.) Rhizome wide-creeping, clothed with spreading, lanceolate, ferruginous scales; stipes about 10 cm. high, firm, erect; frond not much higher, oblong-lanceolate or oval, apex often cuspidate, base rounded, entire, coriaceous, upper surface naked, lower

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matted with appressed tomentum; main veins distinct to the margin; sori rather prominent, in close rows of 4 to 6 between the main veins.

Mount Mariveles, *Loher*.

India to Japan and Malaya.

(5) **N. sphaerostichus** (Mett.). Rhizome woody, wide-creeping, clothed with ovate, acuminate, brown, crisped scales; stipe 6 to 10 cm. high, firm, erect; fronds 10 to 15 cm. high, oblong-lanceolate, acuminate, base narrowed abruptly, coriaceous, upper surface naked, lower sparsely tomentose; main veins distinct to the margin; sori in several series between the transverse veinlets, confluent, covering the whole lower surface.

Luzon, *Cuming* 127.

Celebes.

(6) **N. varius** Kaulf. Rhizome wide-creeping, clothed with scales whose long ferruginous or whitish tips are squarrose near the growing points, appressed farther back, then deciduous leaving the elliptical peltate bases, black in the center; stipes 2 to 5 cm. high, glabrescent; fronds usually somewhat dimorphous, the fertile 15 to 25 cm. high, 1 cm. more or less broad, attenuate to both ends but more abruptly to the base, coriaceous, glabrous or nearly so on the upper surface, the lower very sparsely pubescent, sterile fronds usually shorter and relatively broader; veins invisible; sori distinct but contiguous, covering rather more than the upper half of the frond.

Luzon, *Meyen, Chamisso, Cuming* 17, 67, 88, 135, 240; Benguet, *Barnes* Forestry Bureau 962, *Topping* 343; Mount Arayat, *Merrill* 3822; Corregidor, *Cuming* 286; Romblon, *Copeland* 301; Culion, *Merrill* 545; Samar, *Cuming* 323; Davao, *Copeland* 311, 938.

Java to China and Mariannes.

N. varius is construed here as including *N. elongatus* Bl., *N. pertusus* Spreng., *N. albicans* Bl., *N. Blumeanus* Kunze, and *N. caudatus* Kaulf.

(7) **N. adnascens** (Sw.) Kaulf. Rhizome wide-creeping, clothed with scales whose slender tips are deciduous; stipes 1 to 4 cm. high, erect, puberulous; fronds dimorphous, the sterile rarely more than 6 cm. high, 10 to 15 mm. broad, broadest near the rounded apex, contracted to the stipe, the fertile usually 10 to 15 cm. high, 6 to 10 mm. broad, broadest below the middle, both coriaceous, both surfaces smooth or sparsely pubescent; veins invisible; sori distinct but contiguous, occupying more or less than the upper half of the frond, with dense pubescence between them.

Manila, *Loher;* Tayabas, *Warburg;* Mount Arayat, *Merrill* 3821; Capiz, Panay, *Copeland* 102, 103; Davao, *Copeland* 554, 626, 656; a common epiphyte over beaches.

Africa to Fiji.

(8) **N. nummulariaefolius** (Sw.) J. Sm. Rhizome very slender, wide-creeping, clothed with spreading bright-ferruginous fibrillose scales; stipes scaly, of the fertile frond erect, 5 to 15 mm. high, of the sterile much shorter, horizontal; fronds dimorphous, the sterile 10 to 15 mm. long, orbicular or elliptical, with or without a basal sinus, upper surface glabrous or sparsely stellate, lower with a very dense white or ferruginous tomentum,

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fertile frond about 3 cm. high, 6 mm. broad, widening toward the rounded apex, contracted gradually to the stipe; veins invisible; sori covering the entire back.

Luzon, *Cuming* 246; Rizal *Loher;* Mount Arayat, summit, *Merrill* 3819; Mount Mariveles, *Merrill* 3757; Davao, *Copeland* 694 (along beach), 934.

India to Celebes.

(9) **N. samarensis** (Presl). Rhizome firm, wide-creeping, clothed with deciduous, spreading, white, linear scales; stipe 3 to 10 cm. high, firm, erect; frond 30 to 60 cm. high, 1 to 2 cm. broad, coriaceous, upper surface naked, lower with dense whitish tomentum; veins invisible by reflected light, anastomosing irregularly; sori confluent, occupying the whole surface of the contracted upper half of the frond.

Samar, *Cuming* 323 in part; Albay, *Baranda;* Arayat and Mariveles, *Loher.*

(10) **N. angustatus** (Sw.) J. Sm. Clothed with linear deciduous scales; stipe 6 to 10 cm. high, strong, erect; frond 15 to 30 cm. high, 2 to 5 cm. broad, very coriaceous, upper surface naked, lower clothed with appressed subferruginous tomentum; veins invisible by reflected light, forming fine irregular areolæ; sori large, on the upper third of the frond, near the margin, sometimes confluent.

Luzon, *Cuming.*

India to Tahiti and New South Wales.

(11) **N. splendens** J. Sm. Rhizome short, fibrillose; fronds tufted, sessile or nearly so, 30 to 40 cm. high, one-fourth as broad, obtuse, attenuate to base, coriaceous, upper surface with appressed scattered cottony fibers, lower with dense ferruginous tomentum; main veins distinct and evident to the margin, with straight cross-veinlets, the areolæ thus formed divided into a few smaller ones, with a few free veinlets running in any direction; sori confluent, confined to the upper part of the frond, not reaching the margin.

Rizal, *Loher;* Sorsogon, *Baranda;* Samar, *Cuming* 331; Davao, *Copeland* 684.

(54) POLYPODIUM Linnaeus.

Fronds articulate to the rhizome, the fertile and sterile rarely different, the sterile always green, glabrous or the pubescence not stellate; sori dorsal on the frond, dorsal or terminal on the veins, or on their anastomoses, without indusia. A very large genus, including ferns of every habitat, the Philippine species never bipinnate. The preceding and the four following genera are derived from *Polypodium,* and intimately related to some of its sections. The subgenera are sometimes regarded as genera, as also have been various minor divisions not recognized at all in this arrangement, but all are very intimately related, and their separation costs as much as it gains in convenience, beside demanding many new names.

1. Veins all free ..... § *Eupolypodium*
1. Veins anastomosing to form regular areolæ, each with a single free included veinlet running toward the margin and bearing the sorus ..... § *Goniophlebium*

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1. Veins anastomosing irregularly, with free included veinlets in various directions.
  2. Base of frond like the upper part.
    3. Rhizome not inflated nor inhabited by ants.
      4. Sori not confluent nor in single rows between veins ..... § *Phymatodes*
      4. Sori in single rows between main veins and often confluent ..... § *Selliguea*
    3. Rhizome inflated and inhabited by ants..... § *Myrmecophila*
  2. Base of frond brown and rigid..... § *Drynariopsis*

§ EUPOLYPODIUM.

1. Fronds simple and entire.
  2. Fronds hirsute, with red or brown hairs.
    3. Hairs in stellate clusters..... (1) *P. jagorianum*
    3. Hairs solitary as a rule.
      4. Fronds 3 mm. or less broad.
        5. Hairs long and flexile ..... (2) *P. Christi*
        5. Hairs short and stiff ..... (3) *P. Merrillii*
      4. Fronds larger.
        5. Veins trifid, stipe long ..... (4) *P. setigerum*
        5. Veins once forked.
          6. Fronds obtuse ..... (5) *P. hirtellum*
          6. Fronds narrow, acute ..... (6) *P. setosum*
  2. Fronds glabrous.
    3. Fronds stipitate.
      4. Sori immersed ..... (7) *P. caespitosum*
      4. Sori superficial ..... (8) *P. fasciatum*
    3. Fronds sessile ..... (9) *P. sessilifolium*
1. Fronds crenate or shallowly lobed.
  2. Sori scattered ..... (10) *P. pleiosoroides*
  2. Sori in regular rows parallel to costa ..... (11) *P. lohenanum*
1. Fronds pinnatifid very nearly to the rachis.
  2. Sorus one on each segment.
    3. Segments less than their own width apart.... (12) *P. cucullatum*
    3. Several times their width between segments.. (13) *P. gracillimum*
  2. Sori several on each segment ..... (14) *P. solidum*
1. Fronds pinnate.
  2. Veinlets simple.
    3. Sori superficial.
      4. Pinnæ entire ..... (15) *P. inconspicuum*
      4. Pinnæ slightly crenate.
        5. Lamina hirsute ..... (16) *P. minutum*
        5. Lamina glabrous ..... (17) *P. macrum*
      4. Pinnæ sharply toothed ..... (18) *P. subfalcatum*
    3. Sori immersed.
      4. Sori parallel to costa ..... (19) *P. celebicum*
      4. Sori oblique to costa.
        5. Young sorus almost inclosed.
          6. Frond lax, 25 cm. or more long ..... (20) *P. obliquatum*
          6. Frond firm, usually smaller ..... (21) *P. decorum*
        5. Rim of cavity not covering sorus.
          6. Rim of cavity elevated..... (22) *P. craterisorum*
          6. Rim of cavity plane ..... (23) *P. subobliquatum*
  2. Veinlets forked.
    3. Sori immersed ..... (24) *P. papillosum*
    3. Sori superficial ..... (25) *P. Leysii*

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§ Goniophlebium.

1. Frond simple ..... (26) *P. nummularium*
1. Frond pinnate.
    2. Lamina glabrous.
        3. Margin entire ..... (27) *P. verrucosum*
        3. Margin serrate ..... (28) *P. subauriculatum*
    2. Lamina hairy ..... (29) *P. molliculum*

§ Phymatodes.

1. Fronds simple, not deeply lobed.
    2. Sori in a single row on each side of midrib.
        3. Fronds more or less dimorphous, small.
            4. Main veins evident.
                5. Sori not restricted to upper half (30) *P. neglectum*
                5. Sori restricted to upper half..... (31) *P. rhynchophyllum*
            4. Veins obscure.
                5. Fertile frond broad ..... (32) *P. accedens*
                5. Fertile frond linear ..... (33) *P. hammatisorum*
        3. Fronds alike, minute ..... (34) *P. Rudimentum*
        3. Fronds alike, larger.
            4. Sori round ..... (35) *P. stenophyllum*
            4. Sori oblong ..... (36) *P. longifolium*
    2. Sori in several rows or scattered.
        3. Venation fine or obscure.
            4. Frond narrowly linear ..... (37) *P. tenuilore*
            4. Frond linear-oblanceolate ..... (38) *P. punctatum*
            4. Frond broadly oblanceolate ..... (39) *P. validum*
            4. Frond ovate ..... (40) *P. oodes*
        3. At least the main veins conspicuous.
            4. Main veins falling short of margin.
                5. Base attenuate ..... (41) *P. myriocarpum*
                5. Base rounded ..... (42) *P. linguaeforme*
            4. Main veins reaching margin.
                5. Sori in two rows between main veins ..... (43) *P. triquetrum*
                5. Sori scattered.
                    6. Frond narrowed below.
                        7. Lamina membranous ..... (44) *P. membranaceum*
                        7. Texture firmer.
                            8. Sori numerous.
                                9. Sori round.. (45) *P. Zippelii*
                                9. Sori irregular (46) *P. heterocarpum*
                            8. Sori few, large (47) *P. hemionitideum*
                    6. Base of frond broad..... (48) *P. musaefolium*
1. Shallowly lobed or pinnatifid..... (49) *P. anomalum*
1. Deeply pinnatifid. (Fertile simple entire fronds rare.)
    2. Sori small and scattered.
        3. Textile coriaceous ..... (50) *P. pentaphyllum*
        3. Texture thin.
            4. Stipe naked, winged almost to base..... (51) *P. insigne*
            4. Stipe usually chaffy, less winged..... (52) *P. pteropus*
    2. Sori large.
        3. Fronds dimorphous ..... (53) *P. incurvatum*

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3. Fertile and sterile fronds similar.
4. Sori superficial.
5. Sori uniseriate, rhizome scaly.
6. Frond green ..... (54) *P. trifidum*
6. Lower surface blue ..... (55) *P. glaucum*
5. Sori pluriseriate, rhizome naked ..... (56) *P. affine*
4. Sori shallowly immersed, veins inconspicuous ..... (57) *P. Phymatodes*
4. Sori deeply immersed, veins evident.
5. Segments linear-oblong ..... (58) *P. nigrescens*
5. Segments linear ..... (59) *P. longissimum*

1. Fronds pinnate.
2. Main veins conspicuous.
3. Rachis mostly winged by decurrent pinnæ.... (60) *P. palmatum*
3. Most of rachis not winged ..... (61) *P. angustatum*
2. Main veins not conspicuous.
3. Spots of lime on upper surface..... (62) *P. albidosquamatum*
3. Without lime spots ..... (63) *P. lagunense*

§ SELLIGUEA.

1. Frond simple and entire.
2. Frond membranous.
3. Rhizome scales linear, nearly black..... (64) *P. Selliguea*
3. Rhizome scales lanceolate, brown..... (65) *P. macrophyllum*
2. Frond coriaceous.
3. Apex caudate ..... (66) *P. caudiforme*
3. Apex obtuse ..... (67) *P. vulcanicum*
2. Frond exceedingly leathery ..... (68) *P. Elmeri*
1. Frond deeply pinnatifid ..... (69) *P. ellipticum*

§ MYRMECOPHILA.

1. Frond entire ..... (70) *P. sinuosum*
1. Frond deeply pinnatifid ..... (71) *P. lomarioides*

§ DRYNARIOPSIS.

1. No specialized fertile part of frond..... (72) *P. heracleum*
1. Sori restricted to contracted apical part of frond..... (73) *P. meyenianum*

§ Eupolypodium.

(1) **P. jagorianum** Mett. Rhizome 3 to 10 cm. long, clothed with light-brown chaff; fronds clustered, sessile or narrowed to a very short petiole, the larger ones 10 cm. long and 6 mm. broad, entire, obtuse, coriaceous, clothed, especially near the margin and apex, with reddish hairs about 1 mm. long, usually in stellate clusters; veins almost invisible, forked once; sori near the midrib, on a linear-oblong superficial receptacle.

Philippines *Jagor* 835; Castillo, *Loher;* Mount Mariveles, 1200 m. *Merrill* 3230, *Copeland.*

(2) **Polypodium Christi** Copeland n. Sp. Rhizome short, bearing deciduous stramineous paleæ; stipes clustered, not articulate, 0 to 15 mm. high, beset with short hairs; fronds linear, 4 to 8, or rarely to 15 cm. high, 2 to 3 mm. broad, obtuse or subacute, very gradually attenuate downward, entire or nearly so, subcoriaceous, both surfaces bearing scat-

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tered, stiff, nearly black hairs 1 to 2 mm. long; veins immersed, forked; sori oblong, oblique, superficial, ultimately confluent. Epiphytic on mossy trunks.

Mount Apo, Mindanao, *Copeland* 1520 (Type), 1101.

I conceive this to be the plant from the same locality, *Warburg* 14140, determined by Christ as *P. parasiticum* Mett. *"aut ei proximum;"* and would have let my plants bear the same name and doubt, but that Mettenius' name is invalidated by *P. parasiticum* L.

(3) **P. Merrillii** Copeland. Rhizome erect, short, clothed toward the apex with light-brown scales; fronds minute, the largest 23 mm. high, less than 2 mm. broad, linear-oblanceolate, obtuse, contracted gradually to a very short petiole or sessile, coriaceous, with a pubescence of short, straight red-brown hairs mostly confined to the upper surface and margin; midrib conspicuous, veins simple, almost invisible; sori superficial, near the midrib, and so large that they extend from near the margin to well across it, forming a single wavy line, about 6 sori on a frond.

Paragua, *Merrill* 754, growing on rocks along a small stream in the mountains near the E-wi-ig River.

(4) **P. setigerum** Blume. Rhizome erect or creeping, very short; stipes densely clustered, 3 to 6 cm. high, slender, densely beset with spreading cinnamon-colored hairs about 2 mm. long; fronds 15 to 25 cm. high, about 17 mm. broad, ligulate, obtuse or subacute, entire, herbaceous or subcoriaceous, sparsely clothed throughout with soft hairs like those of the rachis; veins immersed, twice or three times forked; the sori round, large, superficial, dorsal on the first acropetal branch of each vein.

Mount Apo, *Copeland* 1000, 1059, 1204, epiphytic in the mossy forest.

Java and the Moluccas.

(5) **P. hirtellum** Blume. Rhizome short-creeping scaly; frond 5 to 8 cm. long, one-tenth as broad, obtuse, entire, contracted gradually to the short stipe, subcoriaceous, sparsely clothed throughout with long, soft, brown hairs; veins hidden; sori in a single close row on each side of the costa, nearer to it than to the margin.

Luzon, *Steere.*

Java and Ceylon.

(6) **P. setosum** (Blume, Christ). Stipes clustered on an erect rhizome, wiry, hirsute, about 2 cm. high; fronds 9 to 13 cm. long, about 7 mm. broad, narrowed toward both ends, but not acute, entire or very slightly wavy, subcoriaceous, sparsely hirsute; veins once forked, not or but slightly visible by reflected light; sori terminal on the short acropetal branch, superficial, round.

Luzon, *Cuming* 222; Mount Mariveles, *Copeland* 215; Mount Apo, 1,800 m.; *Copeland* 1008.

Java, Celebes.

The Davao plant is typical; that from Mariveles differs in having longer hairs, more abundant near the margin, and veins quite invisible by reflected light, the fertile ones of the broader fronds not infrequently twice forked; but it is not safely separable. Neither can I distinguish *P. Hookeri* Brack., also reported from the Philippines.

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(7) **P. caespitosum** (Blume) Mett. Stipes clustered on a very short chaffy rhizome, 2 to 4 cm. high, wiry, weak, clothed with short weak hairs; fronds 8 to 15 cm. long, rather over one-twentieth as broad at the middle, gradually narrowed toward both ends, entire, subcoriaceous, usually quite glabrous; veins as a rule twice forked, inconspicuous; sori somewhat immersed, oblong, oblique to the costa.

Mount Apo, 1,800 m. *Copeland* 1008a, 1009, 1010.

Java.

A very variable species, especially in the texture and venation, and the shape and direction of the sori; a form occurs rarely with two irregular rows of sori on each side of the costa.

(8) **P. fasciatum** Mett. Rhizome strong, wide-creeping, clothed with broad gray scales; stipes 2 to 5 cm. high, rigid, deciduously ciliate, frond 30 cm. or more long, 1 cm. broad narrowed gradually toward both ends, entire, coriaceous, glabrous; costa prominent, veins immersed, forked; sori superficial, oblong, arranged end to end close to the costa.

Mount Data 2,250 m., *Loher;* a dwarf form, scarcely 7 mm. high, with stipe almost naked.

Malaya.

(9) **P. sessilifolium** Hooker. Fronds tufted, 7 to 22 cm. long, 4 to 6 mm. broad, narrowed gradually below the point, bluntish, entire or slightly undulate, subcoriaceous, glabrous; veins forked; sori oblong, placed end to end close to the costa.

Luzon, *Cuming* 382.

Malaya.

(10) **P. pleiosoroides** Copeland. Rhizome short, creeping, its scales broadly lanceolate, acuminate, stramineous; stipe 2 to 4 cm. high, slender, densely beset with very short stramineous hairs; frond 10 to 15 cm. high, one-tenth as broad, lanceolate, contracted to both ends, coriaceous, glabrous, margin sinuate, especially toward the base, bearing a few short hairs; veins immersed, inconspicuous, about 4 times forked; sori large, round, superficial, in 1 to 3 irregular lines or altogether scattered.

Mount Apo, 1,800 m., *Copeland* 1011, epiphytic.

(11) **P. loherianum** Christ, Bull. Herb. Boiss. 6(1898):197. Rhizome short, with purplish hairs; stipes clustered, 1 to 3 cm. high, naked; frond ligulate-lanceolate, 15 cm. high, 7 to 10 mm. broad, rather obtuse, gradually contracted to the base, crenate-dentate, the teeth of irregular width, 3 mm. or less deep; nervature inconspicuous, veins pinnate in the teeth; sori dorsal on the lowest acropetal veinlets, scarcely immersed, round or oval, in a row rather nearer the costa than the margin, rarely a second imperfect row present; texture coriaceous.

Mount Data, 2,250 m., *Loher.*

(12) **P. cucullatum** Nées. Rhizome short, scaly; fronds very densely tufted, nearly sessile, 7 to 15 cm. long, about 7 mm. broad, but little contracted toward the ends, flaccid, glabrous or nearly so, pinnatifid to the winged rachis into numerous obtuse segments 1.5 mm. broad, separated by less than their own breadth, each with a single conspicuous vein;

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sorus one in each segment, large, superficial, the lower half of the segment folded over it until maturity.

Luzon, *Cuming* 206, *Steere;* Mount Mariveles, *Copeland* 216; Davao, *Warburg* 14188, *Copeland* 1005, 1061.

Ceylon to Samoa.

(13) **P. gracillimum** Copeland. Rhizome creeping or suberect, clothed with minute brown lanceolate scales; fronds in dense clusters, almost sessile, the larger ones 12 cm. long, 4 mm. broad, flaccid, glabrous throughout, pinnatifid almost to the rachis into numerous fine, acute, remote, decurrent, erecto-patent, alternate segments; one vein and one sorus to each segment, the lower half of the lamina folded over the sorus.

Mount Apo, 1,800 m., epiphytic on mossy tree trunks, *Copeland* 1007.

(14) **P. solidum** Mett. Rhizome short, erect, clothed with lanceolate ferruginous scales; stipes clustered, glabrous, 0 to 2 cm. high; frond 8 to 15 cm. high, 1 to 2 cm. broad, narrowed from the middle toward both ends, acute, pinnatifid down very nearly to the ebeneous rachis into erecto-patent sharply serrate or incised acute segments, coriaceous, glabrous or the lower surface glaucous; main veins of the segments conspicuous, veinlets invisible, simple; sori large, round, costal. A small, relatively narrow form, with short, broadly triangular, almost entire segments is *Grammitis denticulata* Blume.

Mount Apo, 1,800 m., *Copeland* 1102, 1103.

Java.

(15) **P. inconspicuum** Blume. Rhizome short-creeping, clothed with linear scales; fronds sessile or nearly so, 10 to 15 cm. high, 1 cm. broad, contracted toward the ends, pinnate; pinnæ erecto-patent, entire, coriaceous, glabrous or glabrescent; veinlets immersed, simple; sori costal.

Davao, *Warburg* 14190.

Java.

(16) **P. minutum** Blume. Stipes tufted, 4 to 7 cm. high, clothed with soft yellowish hairs; frond 10 to 15 cm. high, 2 cm. broad, narrowed toward the ends, pinnate; pinnæ close, erecto-patent, obtuse, crenate, papyraceo-herbaceous, clothed on both sides with soft yellowish hairs; veinlets simple, very short; sori costal, 1 to 3 on each side.

Luzon, *Steere.*

Ceylon, Malaya.

(17) **P. macrum** Copeland. Rhizome short, erect, densely covered with roots, bases of dead stipes and brown scales; fronds crowded, on stipes 1 to 2.5 cm. long, the larger ones 25 cm. high, one-tenth as broad, narrowed toward both ends, curved, lax, pinnate; pinnæ 1 to 2 mm. broad, rather acute, sinuate, decurrent, the upper ones confluent, the lower remote, subcoriaceous, glabrous; veinlets simple; sori superficial, somewhat elongate, nearer the margin than the costa.

Mount Apo, 1,650 m., epiphytic on mossy trunks, *Copeland* 1016.

(18) **P. subfalcatum** Blume. Rhizome short, erect; stipes 1 to 2 cm. high, hairy; fronds about 15 cm. high, 2 to 3.5 cm. broad, narrowed toward

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both ends, pinnate; pinnæ close, spreading, decurrent, sharply toothed, papyraceo-herbaceous, sparsely villose; veinlets simple; sori round, midway between the costa and margin.

Luzon, *Cuming* 113, 205.

Malaya.

(19) **P. celebicum** Blume. Rhizome very short, clothed with linear brown scales; stipes 4 to 8 cm. high, firm, erect, beset with short, cinnamon-colored hairs; frond 35 to 50 cm. high, 5 to 7 cm. broad, apex of mature frond rather abruptly contracted; pinnæ linear, about 3 mm. broad, separated by their own width, acute, entire, coriaceous, glabrescent; rachis short-hairy; veinlets simple, inconspicuous; sori half immersed, oblong, near the margin and parallel to it.

Mount Apo, 1,500 m., *DeVore* and *Hoover* 336, *Copeland* 1004, 1017.

Sumatra to Celebes.

(20) **P. obliquatum** Blume. Rhizome short, clothed with large lanceolate scales; stipe 2 to 4 cm. long, firm, spreading hirsute; frond 20 to 40 cm. long, about 6 cm. broad, pinnate; pinnæ narrowed from broad bases to acuminate apices, horizontal or subfalcate, entire, coriaceous, glabrous; pinnules immersed, simple; sori immersed, the rim of the cavity almost roofing over the young ones, oblong, oblique to the costa, reaching almost from costa to margin.

Mount Mariveles, *Loher;* Davao, *Warburg* 14173, *Copeland* 1018.

India across Malaya.

P. Schenkii Harrington, collected by Steere in Panay and by Loher in Benguet, does not seem to be distinct.

(12) **P. decorum** Brack. Rhizome short, creeping, densely scaly; stipes 0 to 3 cm. high, firm, clothed with exceedingly short hairs or glabrescent; frond 10 to 25 cm. high, rather firm, broadly lanceolate, rather abruptly contracted to the ends, pinnate; pinnæ close, erecto-patent or horizontal, obtuse or acute, coriaceous, glabrous; veinlets simple, invisible; sori immersed and when young almost roofed over, oblique, falling short of both costa and margin.

Benguet, *Topping* 193; Arayat, *Merrill;* Mariveles, *Copeland* 214, *Whitford* 244.

Ceylon to Hawaii.

A small form on mount Mariveles has usually a single sorus in or near the apex of the pinna.

(22) **P. craterisorum** Harrington, Journ. Linn. Soc. **16**:31. Rhizome erect, clothed with brown lanceolate scales; stipes clustered, 1 to 4 cm. high, hirsute with brown hair, firm, erect; frond 20 to 30 cm. long, 4 to 6 cm. broad, oblong or oblong-oblanceolate, tapering above and below, pinnate; pinnæ numerous, linear, about 25 mm. long and 4 mm. broad, obtuse, entire, broadened and more or less confluent at the base, passing below into the narrow lobed wing of the stipe; rachis pubescent, lamina glabrous, membranous; veinlets simple, falling short of the margin; sori confined to the upper part of the frond, immersed, oval, 5 to 10 in a row

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on each side of the costa, about midway between it and the margin; rim of cavity projecting but not overarching.

Mount Majayjay, epiphytic on tree trunks, *Steere.*

(23) **P. subobliquatum** Christ, Bull. Herb. Boiss. 6 (1898) :197. Rhizome short-creeping, sparsely scaly; stipe 1 to 2 cm. high, beset with very short cinnamon-colored hairs; frond 10 to 15 cm. high, 2 cm. broad, oblong-lanceolate; pinnæ obtuse, alternate with broad bases, remote, reduced toward the ends of the frond, 2 mm. broad, coriacous, rufescent, glabrous; veinlets oblique, simple, inconspicuous; sori 4 to 6 on each side of costa, ovate, scarcely immersed, midway between costa and margin, rim of cavity plane, not at all crateriform.

Mount Mariveles, 1,420 m., *Loher.* This fern must be rare, as our rich collections from its type locality contain no representative of the group without more or less crateriform rim around the sorus.

(24) **P. papillosum** Blume. Rhizome wide-creeping, subscaly; stipes 8 to 20 cm. high, firm, erect, almost glabrous; frond 30 to 50 cm. long, 4 to 6 cm. broad, drooping, abruptly acuminate, pinnate, lower pinnæ not reduced; pinnæ close, horizontal, about 4 mm. broad, obtuse, serrate toward the apex, herbaceous, glabrous; veinlets evident, forked; sori nearer the margin than the costa, round, so immersed that they project, often more than 1 mm. from the upper surface.

Luzon, *Cuming* 185; Nueva Vizcaya, *Merrill* 342; Sorsogon, *Baranda;* Davao, *Copeland* 972, 982, 1277.

Malaya.

(25) **P. Leysii** Baker, Journ. Bot. 17 (1879), p. 66.

Sulu Archipelago, *Burbidge.* Description not available.

§ Goniophlebium.

(26) **P. nummularium** Mett. Rhizome wide-creeping, slender, clothed with linear subulate, ferruginous scales; stipes scattered, of sterile frond short, of fertile 6 to 10 cm. high; fronds dimorphous, entire, the sterile suborbicular, scarcely 2 cm. long, the fertile 6 to 10 cm. long and narrowly linear, both coriaceous, glabrous; veins immersed, obscure, anastomosing to form a regular series of triangular and rhomboidal areolæ; sori in a single series, round, superficial, but their position marked on the upper surface of the frond.

Jala-Jala, Rizal, *Meyen;* Laguna, *Cuming* 121.

(27) **P. verrucosum** Wall. Stipes 40 to 60 cm. high, glabrous, erect, terete; frond 30 to 120 cm. high, 30 cm. broad, pinnate; pinnæ numerous, 15 to 20 cm. long, about 2 cm. broad, entire, coriaceous, glabrous or nearly so; veins forming several rows of areolæ; sori confined to the costal areolæ, immersed so as to form distinct papillæ on the upper surface.

Sorsogon and Bataan Island, *Baranda;* Davao, *Warburg* 14155.

Malacca to northern Australia.

P. (Goniophlebium) phlebodioides Copeland (ined.) is a still larger fern with the bases of the pinnæ acute, and mostly three rows of areolæ, differing from *P. verrucosum* in that the pinnæ are broadly serrate.

Mount Apo.

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(28) **P. subauriculatum** Blume. Rhizome wide-creeping, bluish, clothed with broadly linear ferruginous scales; stipes 15 to 35 cm. high, firm, brown, shining, glabrous; frond 40 to 120 cm. long, about 25 cm. broad, firm, more or less horizontal, pinnate; pinnæ 10 to 15 cm. long, one-tenth as broad, acute or acuminate, serrate toward the apex, rounded or auricled on the lower or both sides at the sessile base, herbaceous or subcoriaceous, glabrous; areolæ a single row in the original description, but 2 or 3 rows in more recent descriptions and in most of our specimens; sori only in the costal areolæ, immersed.

Luzon, *Cuming* 244; Benguet, *Loher*, *Barnes* 974; Mount Mariveles, *Merrill* 3208, *Whitford* 318, *Copeland* 1382.

Himalayas to Samoa and New Caledonia.

(29) **P. molliculum** Copeland. Rhizome wide-creeping, clothed with small, subulate, ferruginous scales; stipe about 10 cm. high, suberect, becoming glabrous; frond 15 to 20 cm. high, 8 cm. broad, pinnate; pinnæ narrowly lanceolate, 6 to 8 cm. broad, acute, serrate, or crenate toward the base, short-auricled, more or less truncate, sessile but not adnate, herbaceous, clothed on both surfaces with a short soft tomentum; veins free beyond a single costal series of areolæ; sori scarcely immersed.

Baguio, epiphytic on pines, *Elmer* 6505.

§ Phymatodes.

(30) **P. neglectum** Blume. Rhizome slender, wide-creeping, clothed with grayish-ferruginous scales; stipes scattered, 1 to 2 cm. high, firm, glabrous; sterile fronds broadly ovate, 2 to 2.5 cm. high, 1.5 cm. broad, obtuse, rounded below, entire, coriaceous, glabrous; main veins very distinct almost to the edge, veinlets half evident; fertile frond lanceolate-ovate, obtuse at both ends, 3 to 3.5 cm. high; sori large, round, in a single row, superficial, in well-developed fronds about 5 sori in each row, reaching the entire length of the frond.

Luzon, *Meyen:* Mount Mariveles, on exposed ridges, *Merrill* 3244.

Java.

(31) **P. rhynchophyllum** Hooker. Rhizome firm, wide-creeping, with copious fibrillose bright-ferruginous scales; frond dimorphous, the sterile ones ovate, 3 to 4 cm. long, with stipes about the same length, fertile ones 8 to 15 cm. long, 15 mm. broad, narrowed very gradually upwards, obscurely toothed, on stipes 5 to 10 cm. long, coriaceous, glabrous; main veins distinct to the margin, with copious fine areolæ between them, with free included veinlets; sori uniserial, confined to the upper half of the fertile fronds.

Mount Mariveles, *Loher*.

Upper India.

(32) **P. accedens** Blume. Rhizome wide-creeping, slender, sparsely clothed with linear-subulate, dull brown scales; stipes 2 to 10 mm. high, firm; fronds not very dimorphous, the sterile 2 to 4 cm. high, ovate, obtuse or subacute, rounded or subcuneate at the base, coriaceous, glabrous except for a few dark scales along the margin; veins invisible; fertile

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frond 3 to 8 cm. high, lower broad part sterile, upper part contracted and soriferous; sori rather large, round, in single rows, often confluent, and covering the apex of the frond.

Luzon, *Steere;* Benguet, *Elmer* 6128; Arayat, *Merrill* 3817; Mount Mariveles, *Loher*, *Merrill* 3225, 3750, *Whitford* 314; Mount Apo, *DeVore* and *Hoover* 325, *Copeland;* the Mount Apo plants are larger than those from Luzon.

Malaya and Polynesia

(33) **P. hammatisorum** Harrington, Journ. Linn. Soc. 16(1878):32. Rhizome long and slender, clothed with membranous, long-lanceolate, light brown scales; stipes scattered, those of the sterile frond 1 to 4 cm. high, of the fertile 3 to 7 cm., slender, naked, erect; sterile frond elliptical, 1 to 4 cm. long, 6 to 25 mm. broad, obtuse, coarsely and shallowly crenate except at the tapering base; fertile frond linear, 5 to 12 cm. long, 4 mm. broad, with a lobe under each sorus, coriaceous, glabrous; midrib distinct, veins immersed; sori about 20 in a row on each side of the costa, nearly opposite, large, giving the fertile frond a knotted appearance.

Mount Majayjay, on fallen timber, *Steere.*

(34) **P. Rudimentum** Copeland. Rhizome wide-creeping, slender, clothed with linear-subulate scales; stipes 15 to 25 mm. high, filiform, straight and erect, glabrous; frond orbicular-ovate, the fertile rather the narrower, 10 to 20 mm. long, rounded at both ends, entire or with fine incisions marking the place of teeth, coriaceous, very glabrous; costa disappearing below the apex, veins hidden, anastomosing irregularly or rarely free but hamate; sori few in a row on each side of the costa, nearer it than the margin, round, somewhat immersed.

Baguio, on wet boulders, *Elmer* 6022.

(35) **P. stenophyllum** Blume. Rhizome moderately thick, wide-creeping, densely clothed with linear, pale brown scales; stipes 1 to 2 cm. high, firm, erect; fronds 10 to 12 cm. high, 1 cm. broad, rounded above, attenuate to the base, entire, coriaceous, glabrous; veins immersed, invisible, with few veinlets; sori in single rows near the margin, round, deeply immersed, and prominent from the upper side.

Luzon, *Cuming* 122.

Java to Celebes.

(36) **P. longifolium** Mett. Rhizome short-creeping, woody, its scales linear, very dark; stipe about 2 cm. high, not distinct from frond; frond 30 to 40 cm. high, 10 to 20 mm. broad, subacute, entire and often revolute, attenuate to the base, coriaceous, glabrous or nearly so; veins invisible, areolæ fine, with copious free veinlets; sori oblong, quite immersed, placed in a single row close and parallel to the margin, separated by more than their own length.

Mount Atoc, 1,500 m., *Loher;* Paragua, *Merrill* 752.

Malaya.

(37) **P. tenuilore** Kunze. Rhizome slender, scandent; frond 20 to 50 cm. high, at most 12 mm. broad, acuminate, entire, attenuate to the sessile or short-stipitate base, coriaceous, glabrous; main veins none, areolæ fine,

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invisible; sori minute, copious, scattered, sometimes confluent, especially along the margin.

Mindanao, *Cuming* 287; Catanduanes, *Baranda;* Benguet, *Topping* 262.

(38) **P. punctatum** (L.) Christ. Rhizome short, stout, with sparse scales but usually covered with roots; fronds sessile or nearly so, 30 to 60 cm. high, one-tenth as broad, oblanceolate, acute or obtuse, attenuate to the base, entire, subcoriaceous, glabrous; midrib prominent, veins fine, not immersed, with copious fine areolæ and free veinlets; sori small and copious, scattered irregularly.

Baguio, *Topping* 314, *Elmer* 5884 (large sori); Mount Mariveles, *Copeland* 253, 257 (broad), *Whitford* 197; Rizal, *Merrill* 2353; Mount Apo, *Copeland* 1194.

Tropical Africa across Polynesia.

(39) **P. validum** Copeland. Rhizome short, stout, clothed with ovate, obtuse, cordate or peltate, appressed, brown scales; fronds clustered, almost sessile, broadly oblanceolate, subacute, entire, attenuate to the base, thick-coriaceous, brittle, glabrous; main veins fine but not immersed, running almost to the margin, major areolæ about 7 between costa and margin, each inclosing many fine minor ones; sori numerous, minute, irregularly scattered.

Davao, on rocks along Sibulan River, *Copeland* 973, 1259.

(40) **P. oodes** Kunze. Rhizome slender, clothed with small fibrillose, yellowish scales; stipes distant, slender, glabrous; frond 4 to 6 cm. long, 3 cm. broad, ovate, entire, with rounded but hardly decurrent base, coriaceous, glabrous; main veins distinct nearly to the margin, with fine areolæ and free veinlets; sori rather large, few, scattered.

Philippines, *Cuming* 58; Mount Data, Benguet, *Loher.*

(41) **P. myriocarpum** Mett. Rhizome stout, creeping, sparsely scaly; stipes subclustered, 1 to 2 cm. high; frond 40 to 60 cm. high, 3 to 6 cm. broad, acuminate, entire, attenuate to the base, papyraceous, glabrous or the lower surface pubescent; main veins distinct two-thirds of way to margin, where they are connected, forming a conspicuous row of large rhomboidal areolæ, outside which is a row of smaller ones, both including numerous fine ones; sori numerous, minute, scattered irregularly.

Benguet, *Topping* 346, *Elmer* 6142; Mariveles, *Merrill* 2549, *Copeland* 227, *Whitford* 50; Rizal and Tarlac, *Loher;* Mindoro, *Merrill* 1772.

Cochin China, Malaya.

(42) **P. linguaeforme** Mett. Rhizome stout, short-creeping; frond sessile, 20 to 50 cm. long, 7 cm. broad, narrowed from the middle to three-fourths of the way down, and then dilated again to the broadly rounded base, entire, papyraceous, glabrous; veins very distinctly raised, the main ones irregular, areolæ subquadrangular, with an immersed sorus on free or jointed veinlets in the center of each.

Castillo, *Loher.*

Borneo, the Solomon Isles.

(43) **P. triquetrum** Blume. Rhizome slender, creeping, clothed with brown or whitish, lanceolate, acuminate scales; stipes 3 to 12 cm. high,

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those of the fertile fronds the higher, straight or crooked, stramineous, glabrous; fronds somewhat dimorphous, the sterile 3 to 10 cm. long, lanceolate or ovate, obtuse or acute, entire, rounded or cuneate at the base, coriaceous, glabrous, the fertile frond usually longer and narrower; main veins conspicuous very nearly to the margin, areolæ invisible; sori moderately large, in two rows between each two main veins, round, superficial. Including *P. rupestre* Blume, this species varies exceedingly in the size and shape of the fronds.

Luzon, *Cuming* 245; Benguet, *Loher*, *Topping* 149; Arayat, *Loher;* Mount Mariveles, *Barnes* 346, *Whitford* 126, *Copeland* 1391.

Malaya and Polynesia.

(44) **P. membranaceum** Don. Rhizome stout, clothed with ovate, membranaceous scales; stipe short, winged, erect, firm; frond 30 to 50 cm. high, about 8 cm. broad, narrowed gradually toward both ends, repand or entire, very thin; main veins distinct, with very copious fine areolæ with free veinlets; sori mostly in two rather irregular rows near the main veins.

Philippines, fide Baker, Ann. of Bot. 5:477; Baguio, *Elmer* 5873, *Topping* 226, 263.

Ceylon to west China.

(45) **P. Zippelii** Blume. Rhizome creeping, clothed with thin, lanceolate, squarrose, brown scales; stipes short and stout; fronds about 30 cm. high, 4 to 5 cm. broad, acute, decurrent below, entire or nearly so, submembranaceous, glabrous; venation very evident; sori mostly in rows along the main veins.

Philippines, *Steere;* Sorsogon and Masbate, *Baranda.*

Java.

As originally described this species is very doubtfully distinct from the preceding.

(46) **P. heterocarpum** Blume. Rhizome wide-creeping, clothed with squarrose, linear, dull brown scales; stipes 30 cm. or more high, angular, winged above; frond 30 cm. or more long, oblong-lanceolate, subacute, attenuate below, repand, thin but firm, glabrous; main veins distinct, areolæ rather ample; sori more or less in rows parallel to the main veins, irregular in shape.

Benguet and Rizal, *Loher;* Davao, *Copeland* 962, 965, 1251.

India to Borneo.

(47) **P. hemionitideum** Wall. Rhizome woody, hypogaeous; stipe about 10 cm. high, firm, erect; frond 20 to 50 cm. high, 10 cm. or less broad, narrowed to both ends, entire, subcoriaceous, glabrous; veins very evident, main ones not quite reaching the margin, areolæ rather large; sori large, irregularly arranged.

Isabela, Luzon, *Warburg* 11603, 11621; Mariveles, *Warburg* 11527.

India and south China.

(48) **P. musaefolium** Blume. Rhizome woody, with ovate, dull brown scales; stipe about 1 cm. high, very stout; frond over 1 m. high, 15 cm. broad, oblanceolate, obtuse, nearly entire, broad to the base, coriaceous,

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glabrous; venation evident, main veins running very nearly to the margin, with regular arched cross veins; sori small, in rows parallel to the cross veins and scattered.

Davao, epiphytic forming poor nests, *Copeland* 1295.

Malaya.

(49) **P. anomalum** Christ, Bull. Herb. Boiss. 6(1898):201. Rhizome creeping, clothed with ovate-subulate, crisped, brown scales; stipe 3 to 4 cm. high, stramineous, glabrous; frond 20 cm. high, 15 cm. broad, irregular in form, attenuate below, undulate-crenate, or pinnatifid into lobes of irregular form 3 cm. long, the apex of the frond irregularly dentate, membranous, pale green, especially below, glabrous; main veins distinct, areolæ about 4 series along the costa, large; sori large, round, irregularly pluriseriate.

Mount Data, 2,250 m., *Loher*.

(50) **P. pentaphyllum** Baker, Ann. of Bot. 5(1891):478. Rhizome wide-creeping, woody, 3 mm. in diameter, sparsely clothed with small laceolate-acuminate paleæ; stipe naked, 2 to 3 cm. high; frond 30 cm. or more high, simple in the lower half, forming a mere wing to the rachis, deeply pinnatifid in the middle into distant, linear-lanceolate lobes 1 cm. broad, membranous, green glabrous; veins fine, copious; sori minute, scattered.

Philippines, *Wallis;* Castillo, Arayat, and Los Baños, *Loher*.

(51) **P. insigne** Blume. Rhizome slender, dull brown; stipe 10 to 15 cm. high, often winged throughout, glabrous; frond 10 to 20 cm. high, two-thirds as broad, with an entire, acute, lanceolate terminal lobe one-third the height of the frond and 15 mm. broad, and 2 to 4 similar lobes on each side, separated to within 1 cm. of the rachis, firm-herbaceous, glabrous; venation fine, irregular, visible; sori small, irregularly scattered.

Luzon, *Cuming* 52, Brackenridge.

Malaya.

(52) **P. pteropus** Blume. Rhizome wide-creeping, bearing blackish, lanceolate-subulate scales; stipe 10 to 15 cm. high, naked or as a rule scaly; frond 10 to 20 cm. high, up to 5 cm. broad, rarely simple, usually ternate or pinnatifid, with a large, broad, acute, repand terminal lobe and similar but smaller lateral ones, thin but firm, dark green, glabrous; main veins falling short of the margin, as in *P. punctatum;* sori small, scattered.

Samar, *Cuming* 324.

India and Malaya to Formosa.

(53) **P. incurvatum** Blume. Rhizome creeping, clothed with ovate, whitish, membranous, appressed scales; stipe of sterile frond 10 to 15 cm. high, of fertile 20 to 40 cm. high, erect, firm, glabrous; fronds simple, ternate or pinnatifid, or the fertile even pinnate; the sterile 10 to 20 cm. long, mostly broadly triangular, the lobes broad, entire or repand, acute, coriaceous, glabrous; fertile frond larger, with acuminate lobes about 1 cm. broad; main veins reaching the margin, veinlets invisible; sori large, round, one in each areola, in a single row between midrib and margin, partly immersed.

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Davao, *Warburg* 14162, *Copeland* 1063; different from typical plants in that the sori are not entirely immersed.

Java.

(54) **P. trifidum** Don. Rhizome stout, creeping, clothed with large, lanceolate, squarrose, ferruginous scales; stipe 8 to 20 cm. high, erect, firm, polished; frond 10 to 15 cm. high, most frequently trifid, the segments 10 to 15 cm. long, one-tenth as broad, or the sterile rather broader, acuminate, entire or repand, coriaceous, glabrous, green on both sides; main veins conspicuous to the margin, veinlets obscure; sori in single series, rather nearer the midrib than the margin, one between each two main veins.

Benguet, *Loher*, *Elmer* 5815; Arayat, *Merrill* 3812; Mount Mariveles, *Loher*, *Copeland* 219, *Whitford* 142.

Ceylon to Japan.

This is very probably only an undeveloped state of *P. palmatum*.

(55) **P. glaucum** Kunze. Rhizome creeping, stout, clothed with acicular, stiff, purplish brown paleæ 1 cm. or more long; stipe 15 to 20 cm. high, erect, firm, polished; frond 20 to 30 cm. high, 15 to 20 cm. broad, pinnatifid to within 5 mm. of the rachis into erecto-patent, acute, entire segments 10 cm. long and 7 mm. broad, or the sterile rather broader, coriaceous, glabrous, the under side with a blue bloom; no main veins, veinlets visible from the upper but not from the lower side; sori superficial, round, in single rows near the midribs.

Luzon, *Cuming;* Mount Mariveles, *Whitford* 147, *Copeland* 1392; epiphytic on high ridges.

(56) **P. affine** Blume. Rhizome woody, scaleless; stipe 30 to 45 cm. high, firm, glossy; frond 60 to 120 cm. long, 30 cm. or more broad, cut down nearly to the rachis below, within 1 cm. of it above, into erecto-patent, slightly repand, very acuminate lobes, 15 to 25 cm. long, about 25 mm. broad, papyraceous, glabrous; no main veins, areolæ large; sori superficial, in 2 to 3 irregular rows.

Luzon, *Cuming* 97; Sorsogon and Albay, *Baranda*.

Malaya.

(57) **P. Phymatodes** L. Rhizome wide-creeping, stout, bearing sparse deciduous fibrillose scales, becoming glabrous except for very few appressed ovate black paleæ; stipes 10 to 20 cm. high, erect, firm, polished, brown; frond exceedingly various, sometimes simple, lanceolate or oblong, acute or obtuse, entire or nearly so, 10 to 20 cm. long; usually pinnatifid into segments similar to the simple form, the sinuses reaching to about 1 cm. from the rachis, usually rounded, coriaceous, glabrous; main veins none or very fine and not nearing the margin; sori large, round, immersed, in single or double rows or scattered; epiphytic.

Luzon, *Cuming* 27, 201; Mariveles and Manila, *Loher;* Tayabas, *Merrill* 3353; Mindoro, *Merrill* 1780; Gimogon River, Negros, *Copeland* 77; Davao, *Warburg* 14113, *Copeland* 310, 657.

Africa across Polynesia.

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(58) **P. nigrescens** Blume. Rhizome short, very thick, the ovate scales usually concealed by roots; stipe 10 to 50 cm. high, firm, glabrous, straight; frond rarely simple or ternate, usually pinnatifid to about 7 mm. from the rachis into few or many broadly linear segments, which are acuminate, entire or repand, 20 to 30 cm. long, 2 cm. or more broad, herbaceous, glabrous, dark green; main veins fine, indirect, falling short of margin, included free veinlets copious; sori round, deeply immersed, in single rows nearer the midrib than the margin.

Benguet, *Topping* 339; Mount Mariveles, *Copeland* 1404; Rizal and Laguna, *Loher;* Tayabas, *Warburg* 12756; Sorsogon, Albay, and Camarines, *Baranda;* Davao, *Copeland* 690, 964.

India across Polynesia.

(59) **P. longissimum** Blume. Rhizome very stout, clothed with large, ovate, deciduous scales; stipe stout, 30 to 60 cm. high, polished, stramineous; frond 40 to 100 cm. high, 25 to 35 cm. broad, pinnatifid to the narrowly winged rachis into linear erecto-patent, acuminate, entire or repand segments usually not more than 1 cm. broad, subcoriaceus, glabrous; venation inconspicuous; sori deeply immersed, round, in single rows rather nearer the midrib than the margin.

Rizal, *Merrill* 1356, 2267; south Luzon, *Baranda;* Basilan, *DeVore* and *Hoover* 24 (?).

India to Java and Formosa.

(60) **P. palmatum** Blume. Rhizome creeping, densely clothed with large, spreading, lanceolate-subulate ferruginous paleæ; stipe 15 to 30 cm. high, firm, glabrous; frond 15 to 35 cm. high, 15 to 30 cm. broad, pinnatifid very nearly to the rachis or pinnate; pinnæ 10 to 15 cm. long, 1 cm. more or less broad, broadest in the middle, acuminate, entire or subcrenate, cuneate-decurrent at the base, coriaceous, glabrous; main veins conspicuous, veinlets obscure; sori round, in slight depressions, in single rows, one sorus between each two main veins.

Luzon, *Cuming, Steere;* Benguet, Arayat, and Mount Mariveles, *Loher;* Benguet, *Topping* 189, 292; Mount Mariveles, *Merrill* 3235, *Copeland;* Davao, *Warburg* 14154, *DeVore* and *Hoover* 328, *Copeland* 1062; Jolo Archipelago, *Burbidge.*

Malaya.

(61) **P. angustatum** Blume. Rhizome stout, creeping, clothed with very large, ovate-lanceolate paleæ, brown with scarious margins; stipe 30 cm. high, firm, erect, glabrous; frond 35 to 45 cm. high, pinnate; pinnæ 15 to 20 cm. long, 2 to 3 cm. broad erecto-patent, acuminate obscurely serrate, the lower ones sessile, the upper broadly adnate to the rachis, coriaceous, glabrous; main veins conspicuous, veinlets obscure; sori large, round, superficial, in single rows, one sorus between each two main veins.

Mount Apo, *DeVore* and *Hoover* 330, 341, 376, *Copeland.*

Java and Celebes.

This species is united with *P. palmatum* in Synopsis Filicum and by Christ; but the two Philippine species, each agreeing perfectly with the figure and description of Blume, differ in the size and position of the sori,

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shape, and margin of the pinnæ and their freedom from the rachis, and size of the paleæ.

(62) **P. albido-squamatum** Blume. Rhizome stout, wide-creeping, clothed with reddish or gray-brown paleæ which are ovate at the base and long-subulate; stipe 15 to 40 cm. high, erect, polished; frond 30 to 60 cm. high, about 30 cm. broad, pinnate; pinnæ erecto-patent, linear or lanceolate, very acuminate, entire or nearly so, coriaceous, glabrous, the lower stalked, the upper sessile; main veins visible but not conspicuous, veinlets ending under submarginal lime-spots; sori in single rows, usually nearer the midrib than the margin. Philippine specimens are mostly narrower than the type, belonging in *P. varians* Blume, which is not a distinct species.

Luzon, *Cuming* 202, 236; Mounts Arayat and Mariveles, *Loher;* Benguet, *Topping* 150, 215, 202, *Elmer* 6263; Mount Mariveles, *Copeland;* Jolo Archipelago, *Burbidge.*

Malaya.

(63) **P. lagunense** Christ, Bull. Herb. Boiss. 6(1898):201 cum Icone. Rhizome wide-creeping, solid, clothed with ovate-subulate, umbonate, reddish-brown appressed scales; stipe 10 to 15 cm. high, firm, glabrous; frond 15 to 20 cm. high, 10 to 15 cm. broad, pinnate, dimorphous; pinnæ of the sterile frond 6 or 7 on each side, remote, oval, 4 cm. long, 2 cm. broad, acuminate, subcrenate, sessile or short-stalked, coriaceous, glabrous; pinnæ of fertile frond linear-lanceolate, caudate, erecto-patent, 12 cm. long, 4 to 10 mm. broad, crenate; costa prominent, veins inconspicuous, veinlets hidden; sori large, round, immersed, in single rows, one sorus between each two main veins, midway between costa and margin.

Los Baños, Laguna, *Loher.*

§ Selliguea.

(64) **P. Selliguea** Mett. (*Gymnogramme membranacea* Hooker). Rhizome wide-creeping, clothed with small, linear, nearly black scales; stipe 5 to 15 cm. high, nearly naked; frond 15 to 30 cm. high, 2 to 4 cm. broad, very acuminate entire, attenuate below and decurrent, papyraceo-herbaceous, glabrous; main veins distinct to the margin but zigzag and very slender, united by similar transverse veinlets to form large hexangular areolæ; sori in oblique interrupted lines, one line between each two main veins.

Samar, *Cuming* 325, 334.

Malaya.

(65) **P. macrophyllum** Mett. Rhizome creeping, clothed with small, dark, lanceolate scales; stipe 2 to 3 cm. high, firm, scaly; frond 30 to 60 cm. high, 6 to 8 cm. broad, narrowed gradually toward both ends, entire or repand, papyraceous, glabrous; main veins conspicuous, not straight, areolæ rather quadrangular, free veinlets evident; sori in single continuous or interrupted rows between the main veins.

Bohol, *Cuming* 351; Rizal, *Loher;* Benguet, *Barnes* 967.

Malaya.

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(66) **P. caudiforme** Blume. Rhizome wide-creeping, clothed with ovate-lanceolate, scarious-ferruginous scales; stipe 10 to 20 cm. high, firm, glabrous; frond 10 to 20 cm. high, the fertile lanceolate, the sterile ovate, long-acuminate, entire or crenate, rounded or acute at the base, coriaceous, glabrous; main veins conspicuous, reaching the margin, veinlets invisible; sori large, globose or elongate, as wide as the space between the main veins, rarely confluent; epiphytic.

Mount Apo, 1,800 m., *Copeland*, 1055, 1106.

Malaya and Polynesia.

(67) **P. vulcanicum** Blume. Rhizome creeping, clothed with ovate, brown scales; stipe of the sterile frond 3 to 8 cm. high, of the fertile 8 to 20 cm., rigid, glabrous; sterile frond 3.5 to 6 cm. high, ovate, obtuse, rounded below, entire, coriaceous, glabrous; fertile frond 5 to 12 cm. high, ovate-lanceolate, obtuse, acute at base; main veins conspicuous, falling short of margin, or barely reaching it, veinlets invisible; sori globose, mostly confluent in rows from the costa to the margin, so large that they touch across the main veins; terrestrial.

Mount Apo, above 2,100 m., *DeVore* and *Hoover* 337, *Copeland* 1048.

Sunda to Celebes, highest mountains.

(68) **P. Elmeri** Copeland. Rhizome creeping, stout, clothed with ovate, acuminate scales 6 mm. long, with peltate, black-centered bases; stipes stout, dark, glabrous, that of the sterile frond 3 to 6 cm. high, of the fertile 15 to 20 cm.; sterile frond ovate-triangular, about 10 cm. high, 6 to 8 cm. broad, obtuse, entire or subrepand, abruptly truncate at base, glabrous, very rigidly coriaceous; main veins conspicuous, reaching the margin, veinlets invisible; fertile frond 10 cm. high, 4 cm. broad, acute, subentire, cuneate at base, coriaceous; sori uninterrupted, reaching from the costa to the margin, not quite filling the space between the main veins; epiphytic.

Mount Santo Tomas, Benguet, *Elmer* 6547.

(69) **P. ellipticum** Thunberg. Rhizome creeping, woody, bearing small, lanceolate, brown scales; stipe 30 to 60 cm. high, firm, naked; frond 30 to 50 cm. high, 15 to 30 cm. broad, pinnate below, rachis winged above; pinnæ or segments 7 to 11 on each side, about 20 cm. long, linear-lanceolate, acute, entire, herbaceous, glabrous; venation conspicuous, main veins zigzag, not reaching the margin, areolæ large, irregular, mostly with single free veinlets; sori linear, oblique, touching the midrib but not the margin; terrestrial. Includes *Selliguea pothifolia* J. Sm.

Luzon, *Cuming* 53; Benguet, *Elmer* 5876, *Barnes* 963; Rizal, *Loher;* Mount Mariveles, *Loher*, *Merrill* 3116, *Copeland* 220; Catanduanes, *Baranda;* Samar, *Cuming;* Davao, *Copeland* 1256.

India to Japan and Queensland.

§ Myrmecophila.

(70) **P. sinuosum** Wallich. Rhizome wide-creeping, tubular, 1 to 3 cm. in diameter, covered with roundish peltate scales with black center and scarious margin; stipes brown, erect, glabrous, of sterile frond about 4 cm. high, of fertile about 6 cm.; sterile frond about 10 cm. high, 1.5 to

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2 cm. broad, obtuse, base subacute, entire, subcoriaceous, glabrous; fertile frond about 20 cm. high, 1.5 to 2 cm. broad, subacute, acute at base, subcrenate; veins hidden, main veins not reaching margin; sori large, round, immersed, in single rows nearer the margin than the costa.

Tayabas, *Merrill* 3355; Negros, *Copeland* 101.

(71) **P. lomarioides** Kunze. Rhizome forming a thick, wide-spreading crust, thickly clothed with small, peltate scales which are ferruginous in the center, with a scarious border; stipe about 10 mm. high, erect; frond 30 to 50 cm. high, 10 to 15 cm. broad, the sterile pinnatifid into close, horizontal, oblong, entire, obtuse lobes 2 cm. broad, the fertile cut nearly to the rachis throughout into more numerous lobes, hardly 1 cm. broad, coriaceous, glabrous; veins hidden, irregular; sori round or oblong, completely immersed, in single rows near the midrib.

Luzon, *Cuming* 242 (?).

Malaya to Formosa.

§ **Drynariopsis.**

(72) **P. heracleum** Kunze. Rhizome very stout, clothed with long, fibrillose, light-brown scales; fronds seriate, 100 to 350 cm. long, 60 to 100 cm.; broad, the base reduced to a broad rigid wing, 15 cm. broad, weak in chlorophyll, the upper part cut down nearly to the rachis into acute entire lobes 50 cm. long, 10 cm. broad, rigidly coriaceous, glabrous; main veins distinct to the margin, with about eight series of large areolæ inclosing numerous small ones with free veinlets; sori small, numerous, scattered, slightly immersed.

Sorsogon and Catanduanes, *Baranda;* Mindoro, *Merrill* 1800.

Java, Celebes.

(73) **P. meyenianum** Schott. Rhizome very stout, densely beset with long, linear, crisped, ferruginous scales; frond 60 to 100 cm. high, the basal part about 15 cm. broad, shallowly lobed, rigid, brown; the sterile vegetative region 40 to 60 cm. high, 20 to 30 cm. broad, pinnatifid almost to the rachis into erecto-patent obtuse, entire lobes 2 to 3 cm. broad, coriaceous, glabrous; main veins reaching the margin, between them four or five series of rather regular major areolæ, each including about eight rectangular minor ones; apical fertile part about 30 cm. high, pinnate, the pinnae sinuous, narrowly linear, about 20 cm. long, lobed to the midrib into roundish segments, each covered by a single sorus.

Luzon, *Cuming* 49; Mount Mariveles, *Merrill* 3224, *Whitford* 221, *Copeland* 1386, on lofty ridges.

(55) LECANOPTERIS Blume.

Rhizome creeping, inflated, cavernous and inhabited by ants; fronds on conical cavernous outgrowths of the rhizome, pinnatifid or pinnate; veins anastomosing with free included veinlets; sori on reflexed marginal outgrowths of the fronds, facing upward. Epiphytic, usually in the tops of lofty trees. Closely related to some species of Polypodium.

(1) **L. carnosa** Blume. Rhizome and phyllophores forming a thick close covering over the host, glabrous on the outside; stipes about 5

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cm. high, glabrous; fronds 20 to 30 cm. high, about 5 cm. broad, rachis winged throughout; segments broadly or narrowly ovate, acute, contracted at base, margin shallowly lobed by the soriferous projections, coriaceous, glabrous; veins inconspicuous.

Leyte, *Cuming* 312; Mount Mariveles, *Whitford* 334.

Malaya.

(2) **L. pumila** Blume, Flora Javæ T. 2, Tab. 94. Rhizome as in the preceding; stipe about 10 cm. high, glabrous; frond 20 to 30 cm. high, about 7 cm. broad, rachis winged throughout; segments lanceolate, obtuse, hardly contracted at the base, lobed by the soriferous projections, firm but pellucid; veins conspicuous. Blume's figure of this species (and of the preceding as well) is unaccompanied by any description; the most conspicuous difference between them seems to me to be in the form and apex of the segments, and I have used his names for my plants on the assumption that that difference is diagnostic. The difference in texture would be less easily figured.

Davao, *Copeland* 1299.

Java.

(56) PHOTINOPTERIS J. Sm.

Rhizome creeping; frond pinnate, the lower pinnæ sterile, each subtended by a stipule-like outgrowth, the upper fertile, very narrow, all articulate to the rachis; veins anastomosing, with free included veinlets in all directions; sori occupying the entire under side of the fertile pinnæ. Epiphytic. The sterile plants are readily recognizable by the auricles subtending the pinnæ.

(1) **P. speciosa** (Bl.) J. Sm. Rhizome bluish, clothed with dirty-brown fibrillose scales; stipe hardly 1 cm. high, glabrous and brown, like the rachis; sterile pinnæ 10 to 15 cm. long, half as broad, ovate, abruptly acuminate, subcuneate at the base, entire, coriaceous, glabrous; main veins and cross-veinlets forming large areolæ evident, veinlets forming smaller areolæ inconspicuous; fertile pinnæ 10 to 15 cm. long, 3 mm. broad, deciduous. A form with a single fertile pinnæ was named *P. simplex* J. Sm.

Luzon, *Cuming* 64; Arayat, 800 m., *Loher;* Mindoro, *Cuming* 362; Davao, *Copeland* 649.

Malaya.

(57) DRYOSTACHYUM J. Sm.

Rhizome stout, creeping, scaly; fronds pinnatifid, the segments articulate to the rachis; venation evident, with major, divided into minor areolæ, with free included veinlets; sori only on the contracted upper part of the frond, coalescing so that each major areola includes a single cushion of sporangia. Epiphytic, with large, conspicuous fronds, more or less clustered into nests. Intimately related to Drynaria.

(1) **D. splendens** J. Sm. Fronds sessile, the lower part brown, rigid, collecting humus into which the roots run, as the cup-leaves of Drynaria do, shallowly lobed, about 20 cm. broad and more than as high; above this a narrower part, about 40 cm. high and less than 10 cm. broad,

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sinuate-lobed; above this 50 cm. or more of the sterile region, pinnatifid within 1 cm. of the rachis into erecto-patent segments about 25 cm. long and 4 cm. broad; finally the fertile apex, more than 30 cm. high, cut to the rachis into segments 10 to 20 cm. long, about 1 cm. broad, separated by twice their own breadth; sori occupying the entire dorsal surface except the midrib and main veins running to the margin.

Luzon, *Cuming* 87; Benguet, *Topping* 245; Davao, *Copeland* 1285.

Malacca to New Guinea.

(58) DRYNARIA Bory.

Rhizome very stout, scaly, creeping; fronds of two kinds, (*a*) cup-leaves, brown, rigid, like sessile oak leaves, and (*b*) ordinary leaves, large, green, pinnatifid, with segments deciduous from the rachis, or pinnate; veins anastomosing copiously, with free included veinlets in all directions. Large, conspicuous epiphytes. The cup-leaves collect quantities of detritus, forming a soil into which the roots grow.

(1) **D. quercifolia** (L.) Bory. Scales of the rhizome about 1 cm. long, brown, narrowly lanceolate, from a cordate base; cup-leaves 20 to 30 cm. long, 15 to 20 cm. broad, shallowly lobed below, deeply toward the apex; normal fronds on petioles sometimes 35 cm. long, winged nearly or quite to the base; frond 60 to 100 cm. long, about 30 cm. broad, pinnatifid as a rule to about 5 mm. from the rachis, into segments 10 to 15 mm. broad; sori in regular rows, one row on each side of each main vein running to the margin.

Luzon, *Cuming* 25, 273, 414; Nueva Viscaya, *Merrill* 311; Benguet, *Topping* 174, 344; Mount Mariveles, *Whitford* 372; Sorsogon, Catanduanes, Bataan, and Masbate, *Baranda;* Culion, *Merrill;* Capiz, Panay, *Copeland* 70; Guimaras, *Ritchie, Forestry Bureau,* 36; Cebu, *Barrow* 21; Davao, *DeVore* and *Hoover* 161, *Copeland* 1321.

India to Melanesia and Queensland.

(2) **D. Linnaei** Bory. Scales of the rhizome broadly ovate with peltate base; cup-leaves bluntly lobed; normal fronds 60 to 100 cm. long, 15 to 30 cm. broad, long stalked, cut down nearly to the rachis into entire, erecto-patent lanceolate lobes, rigid, glabrous; sori small and scattered.

Cagayan, Luzon, *Warburg* 12209, 12210; Davao, *Warburg* 14141.

Ceylon to Polynesia and Queensland.

(3) **D. rigidula** (Sw.) J. Sm. Rhizome creeping, intertwined, clothed with ferrugineous, black-centred, long-pointed scales; cup-leaves sessile, deeply cordate, oblong, narrowed upward, 15 to 25 cm. long, sinuate near the base, deeply lobed toward the apex; normal leaves pinnate, 50 to 100 cm. or more long; pinnæ 10 to 25 cm. long, broadly linear, acuminate, unequal-sided at base, on short, winged petiolules, very readily cast, serrate, glabrous, hard; fertile pinnæ usually narrower than the sterile, with a single row of round, immersed sori along each side of the costa. A tree-top fern, forming large nests.

Philippines, *Cuming* 248, 263; Mindanao, *Copeland* 1644.

Malacca to Polynesia and Australia.

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VIII. ACROSTICHEÆ.

Fronds articulate to the rhizome or not so, simple, dichotomous, or pinnate, when pinnate the pinnæ equal-sided; sterile and fertile fronds or parts of fronds distinct but not usually very different; sporangia covering the fertile surface, without being collected into sori; indusia therefore wanting.

1. Fronds pinnate, or the primary venation so.
    2. Fronds simple ..... (59) *Elaphoglossum*
    2. Fronds pinnate ..... (60) *Achrostichum*
1. Fronds or main veins dichotomous.
    2. Stipe present, not articulate ..... (61) *Cheiropleuria*
    2. Fronds sessile, articulate to rhizome..... (62) *Platycerium*

(59) **ELAPHOGLOSSUM** Schott.

Rhizome in our species creeping; fronds simple, entire, firm in texture, the fertile and sterile not exceedingly different, clothed with broad, ornate scales or glabrous; veins free unless at the margin; sporangia densely covering the lower surface. A large genus in tropical America; sparingly represented in the Old World. Our species are epiphytes of rather small size.

1. Margin cartilaginous, not ciliate ..... (1) *E. conforme*
1. Margin ciliate.
    2. Surface glabrous ..... (2) *E. decurrens*
    2. Surface somewhat scaly ..... (3) *E. Cumingii*

E. latifolium (Sw.) J. Sm. was reported by Harrington from Steere's collection from Luzon: the species is usually regarded as exclusively American, and this determination was probably not quite accurate, or the specimen may have been ascribed to the wrong region, as Steere collected in tropical America.

(1) **E. conforme** (Sw.) Schott. Rhizome woody, creeping or scandent, clothed with large ovate, membranous paleæ 5 mm. long; stipes 5 to 15 cm. high, firm, erect, stramineous, glabrescent; frond 15 to 25 cm. high, 1.5 to 3 cm. broad, obtuse, cuneate at the base, entire and cartilaginous at the margin, coriaceous, glabrous; veins mostly once forked.

Benguet and Arayat, *Loher;* Mount Mariveles, 1,200 m., *Merrill* 3250, *Copeland* 1384.

Pantropic.

Achrostichum ophioglossoides Mett. is a small thick-leaved form collected at Manila by *Meyen.*

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(2) **E. decurrens** (Desv.). Rhizome woody, the paleæ large, ovate, dull brown; stipe 6 to 10 cm. high, firm, erect, scaly; frond 10 to 15 cm. high, 5 cm. broad, round at the apex, narrowed gradually to the stipe, very thick, surface glabrous, but the margin densely fringed with ovate, yellowish, toothed, deciduous scales 1 mm. long; veins immersed, nearly hidden.

Luzon, *Cuming* 144.

(3) **E. Cumingii** (Fee). Rhizome woody, clothed with large, ovate, dull brown scales; stipe 15 to 20 cm. high, firm, erect, scaly below; sterile frond 20 cm. high, 3 cm. broad, obtuse, narrowed gradually below, margin densely fringed by mostly slightly intramarginal minute scales; frond very thick, surfaces, especially the upper, clothed with minute, scattered scales; veins quite hidden; fertile frond as long as the sterile but rather narrower.

Luzon, *Cuming* 193; Arayat, *Loher.*

(60) ACHROSTICHUM Linnaeus.

Rhizome thick, erect, stipes not articulate to it; frond large, simply pinnate; pinnæ with prominent costa, and veinlets copiously anastomosing, without free included veinlets; sporangia covering the backs of the fertile pinnæ, except for the costa and sometimes for a narrow marginal line. Large terrestrial ferns, in brackish marshes throughout the Islands. The genus *Achrostichum* formerly included all ferns with the sporangia covering the fruiting surface, without evident differentiation of sori; which was probably more convenient than the present, presumably more natural, arrangement.

(1) **A. aureum** L. Rhizome woody, somewhat scaly; stipe 30 to 60 cm. high, stout, erect, polished; frond 60 to 200 cm. high, 30 to 60 cm. broad; pinnæ numerous, 15 to 30 cm. long, about 5 cm. broad, stalked, obtuse or sometimes retuse and bluntly mucronate, entire, glabrous, leathery; areolæ small, evident; upper pinnæ fertile, hardly as large as the sterile.

Manila, *Loher, Marave, Merrill* 57, *Elmer* 5510; Camarines, Bataan, and Masbate, *Baranda;* Iloilo, *Copeland,* including a freak with forked pinnæ; Davao, *Warburg;* Balabac, *Steere.*

Pantropic.

(61) CHEIROPLEURIA Presl.

Rhizome creeping, stipes not articulate to it; fronds dimorphous, the sterile dichotomously veined and lobed, fertile linear, costate; sori covering the lower surface, excepting costa and margin. A fern remarkably distinct in appearance, epiphytic or terrestrial in the mossy forest.

(1) **C. bicuspis** Presl. Rhizome short, stout, densely clothed with golden, jointed, hairs; stipes 20 to 40 cm. high, angular, stramineous, naked except at the base; sterile frond about 10 cm. long, ovate or, if the tips spread, as broad as long, normally lobed half way to the base by a broad sinus into two erect or spreading acute lobes, entire, subcuneate at base, glabrous, thin-coriaceous; main veins dichotomous; veinlets anas-

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tomosing, with copious branched included veinlets; fertile frond about 15 cm. long, 1 cm. broad.

Tonglon and Arayat, *Loher;* Baguio, *Topping* 153, *Elmer* 5844; Mount Mariveles, *Copeland, Whitford* 331.

Java to Formosa and New Guinea.

(62) PLATYCERIUM Desvaux.

Fronds articulate into a depression in the short rhizome, remarkably dimorphous; "basal fronds," reniform in general form, sessile, closely applied to the substratum, imbricate, sheltering the roots; and "normal fronds," standing out from the substratum, dichotomously branched, fertile in definite parts; pubescence stellate; main veins dichotomous, veinlets anastomosing, with free included veinlets, the mesh especially fine under the fertile surface. A most natural genus of tropical epiphytes, whose extraordinary appearance has made them universal favorites in cultivation.

(1) **P. grande** J. Sm. Basal frond very large, suborbicular, convex, or the upper ones erect, deeply laciniate with spreading or inflexed divisions; normal frond 1 to 2 m. long, pendent, in pairs, each with a single fertile region on the broadly cuneate base, to which the two repeatedly dichotomous appendages are attached; glabrous.

Luzon, *Cuming* 157 (fide J. Sm.); Albay, Ticao, and Masbate, *Baranda;* Davao, *Loher.*

Singapore to north Australia.

(2) **P. biforme** (Sw.) Blume. Basal fronds imbricate, very thick especially toward the base, margin irregularly lobed; normal fronds 1.5 to 5 m. long, repeatedly dichotomous from a small subcuneate base, the sterile division 2 to 3 cm. broad, continually forking, the fertile distinct, stalked, reniform, entire, 15 to 20 cm. broad. (See frontispiece.)

Luzon, *Cuming* 156; Albay, Ticao, and Masbate, *Baranda;* Davao, *Warburg* 14147.

South India across Malaya.

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INDEX TO GENERA AND SUBGENERA.

[Names of subgenera are given in italics.]

	Page.
Achrostichum	137
Adiantum	92
Allantodia	71
Antrophyum	108
Arcypteris	33
Arthropteris	45
Aspidium	33
Asplenium	76
Athyrium	87
Blechnum	89
Callipteris	69
Cheilanthes	95
Cheiropleuria	137
Christopteris	111
Coniogramme	66
Cyclopeltis	16
Darea	86
Davallia	52
Dennstaedtia	57
Diacalpe	14
Didymochlaena	15
Diplazium	71
Dipteris	44
Doryopteris	94
Drymoglossum	112
Drynaria	135
Drynariopsis	133
Dryostachyum	134
Elaphoglossum	136
Goniophlebium	123
Goniopteris	20
Gymnopteris	41
Hemionitis	67
Histiopteris	104
Humata	49
Hymenolepis	110
Hypolepis	95
Lastraea	19
Lecanopteris	133
Leucostegia	50
Lindsaya	59
Lomaria	89
Loxogramme	68
Meniscium	32
Microlepia	55
Monachosorum	58
Monogramme	106
Myrmecophila	132
Neottiopteris	78
Nephrodium	18
Nephrolepis	46
Niphobolus	112
Nothochlaena	97
Odontosoria	56
Oleandra	48
Onychium	98
Paesia	105
Photinopteris	134
Phymatodes	124
Plagiogyria	97
Pleocnemia	34
Platycerium	138
Polybotrya	39
Polypodium	115
Polystichum	16
Prosaptia	52
Pteridium	104
Pteris	98
Platytaenia	111
Saccoloma	52
Sagenia	33
Schizoloma	58
Selliguea	131
Stenochlaena	88
Stenosemia	48
Synaphlebium	60
Syngramme	69
Taenitis	111
Tectaria	34
Triphlebia	87
Vittaria	107
Wibelia	55
Woodwardia	91

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II. NEW SPECIES OF EDIBLE PHILIPPINE FUNGI.

By EDWIN BINGHAM COPELAND, Ph. D., *Botanist.*

It is still true of the Philippine Archipelago, as until within a decade it was of the entire Orient from Ceylon to Japan and Australia, that its fungus flora is a practically untouched field. From the little work in it that has been possible for us, it appears that our *Agaricaceæ,* at least, are almost entirely new to science as well as locally unknown. It can also be safely said, contrary to a rather prevalent opinion of the condition in tropical countries, that our *Basidiomycete* flora is a very rich one, in species if not in individuals.

As to their edible properties, the writer has personally tested more than 100 Philippine species, and can state with the confidence personal experience justifies that the species described here are without exception palatable and harmless. In the individual descriptions the statement as to taste and odor apply of course to the mushrooms when raw and fresh. The diagnoses of these fungi were originally written in Latin. However, it was thought inadvisable to have them appear as a Government publication in this language; therefore the following translation has been made, and the Latin diagnoses are published in Annales Mycologici, volume 3, No. 1:

Lycoperdon todayense Copeland. Peridium obovate or pyriform, 1 to 2 cm. in height, 1 to 1.5 cm. in thickness, plicate at the base, entire above, clothed when young with minute deciduous warts or flakes which are hyaline when moist, later finely and obscurely areolate, white at first, turning yellow, opening by a small aperture at the top; the fertile gleba very distinct from the sterile, cellular base; spores globose, smooth, 3.5 to 4 μ in diameter; capillitium rudimentary, irregular, thick.

Todaya, Davao, caespitose about the base of a Musa.

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Coprinus confertus Copeland. Gregarious and caespitose, varying greatly with the weather; pileus fleshy, conical; if grown in dry weather very thick, covered with appressed, whitish, cottony flakes, the margin entire or cleft a few times; but when rainy thinner, clothed with an evanescent, silky net, grayish-black, striate, with tawny or stramineous disk and lacerate margin; gills grayish-black, crowded, lanceolate, free but close; spores ovate, 14 to 16 by 7.5 to 9 μ, truncate, black; stipe white, smooth, hollow, in dry weather turbinate, 2.5 cm. high, 1.5 cm. thick; but when rainy, as much as 16 cm. high, 6 to 15 mm. thick, equal, or narrowing upward, base equal or subbulbose, with a strong radical cord.

Manila, on horse manure.

This species is near *C. picaceus* Fries, differing from it chiefly in the strongly rooting base and in growing on manure instead of on ground.

C. ater Copeland. Odorless, with fairly agreeable taste; pileus obtusely conical at first, becoming plane, 14 mm. broad, disk tawny, periphery passing from dark gray to very black, bearing minute, deciduous, dark brown scales or granules, the flesh 30 μ thick; gills free, narrow, black; spores black, 15 by 9 μ, exstipitate; stipe fistulose, smooth, white, equal, or narrowed upward, at most 5 cm. high, 1.5 mm. thick, most often 2.5 cm. high, 0.8 mm. thick.

Davao, on horse manure.

C. ornatus Copeland. Odorless, with fair flavor; pileus passing from campanulate to broadly conical, obtuse, 12 mm. wide, sulcate, the disk tawny, ornately beset with dark brown granules, the periphery smooth or pulverulent, changing from white or tawny to black; gills 7 mm. long, 1.2 mm. deep, narrowly adnate, without cystidia; spores 10 by 7 μ, black; stipe straight, 2.5 cm. or less high, 1 mm. thick, equal or slightly contracted upward, smooth, white or hyaline, with ferruginous base, scarcely hollow.

Gimogon River, Negros, on wood of various kinds, and ground in chip-yard, mostly solitary. Related to *C. Staudtii* Hennings.

C. Bryanti Copeland. Pileus passing from white through brown to black, smooth, campanulate, 6 to 8 mm. high, 5 mm. wide, thin, odorless, fine-flavored; gills free but touching the stipe, 1 to 1.5 mm. deep, dark brown, obtuse; stipe straight, white, solid, 2.5 to 3 cm. high, 1.5 mm. thick, equal, smooth, substriate at the top, wih scarcely thickened base surrounded by white hairs 1.5 mm. long; veil obsolete; spores smooth, brown, 8 by 4.5 μ, with hyaline, truncate apex.

Gimogon River, Negros, on a rotten Ficus trunk; a smaller form collected on rotten wood by the Baroring River, Mindanao. This is a real *Coprinus*, in spite of the spore color of *Bolbitius*. It bears the name of R. C. Bryant, of the Forestry Bureau, my host when it was collected.

C. concolor Copeland. Odor none, taste mild; pileus conical, with spreading margin, about 2.5 cm. high and wide, subfleshy, brown, very smooth and naked, deliquescing first at the lacerate margin; disk brownish, subumbonate; gills 2 mm. deep, free, crowded, obtuse, remaining a long time pale, then turning dark at their edges first; spores dark brown, 8 by

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COPRINUS CONFERTUS COPELAND.

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4.5 μ; cystidia wanting; stipe about 9 cm. high, 5 mm. thick or a little more at the base, white or brownish, smooth, hollow, without annulus.

Todaya, Davao, terrestrial in forest.

Eaten by the Bagobos, who call it "ligbus."

C. volutus Copeland. Pileus 1 to 1.5 cm. wide, thin, naked, early explanate and later revolute or involute, turning from gray to black, the flat disk ferruginous and warty; gills free but very close, at first obtuse at both ends, soon splitting from the top of the pileus but not from the margin, spores black, narrowly ovate, 12 to 13 by 6.5 μ; stipe 4 cm. high, 1 to 1.5 mm. thick, slightly attenuate upward, white, naked, hollow.

Manila, on rotting leaves.

Differs from *C. deliquescens* Fries in that the lamellæ are so close to the stipe as to appear adnate.

C. revolutus Copeland. Pileus 2 cm. or less wide, passing from campanulate through plane to broadly revolute, the disk flat and brown-granulose, the periphery subfurfuraceous, sulcate; gills 70 or less, barely touching the stipe, narrow, acute at both ends, black; spores 11 to 13 by 8 μ, black, apiculate at base; stipe about 10 cm. high, 1 to 1.5 mm. thick at the top, 2 to 2.5 mm. toward the base, white, hollow, fragile, velvety below.

Manila, coprophilous.

Related to *C. nebulosus* Zoll., but distinguished by the stipe's being velvety below but not bulbous; similar to *C. rostrupianus*, but essentially different in the split gills. Among the species of its own section, this is notable for its crowded gills.

C. rimosus Copeland. Pileus 1.5 to 2 cm. high and wide, thin, cylindric-campanulate or conical, truncate, naked, very early split downward through the gills and so plicate in appearance, tawny-gray outside, turning black in clefts, the tawny disk flat or concave; gills free and somewhat remote, cut away toward the stipe, obtuse at the margin, black, becoming pale with age, without cystidia; spores 15 by 13.5 μ. black, typically subangular and broadest toward the apex, stipe hollow, white, naked, equal.

Manila, on horse manure.

This species differs from *C. plicatilis* Fries in the non-explanate pileus, broader spores and habitat of manure.

C. pseudo-plicatus Copeland. Pileus early flattened out, about 3 cm. wide, thin, at first squamulose, becoming black because of its thinness, deeply split downward through the gills, making the structurally entire margin cuspidate-dentate; disk brown, subumbonate, or in age concave; gills about 60, 3 mm. deep, adnate to a narrow collar, black, or pale after the spores are cast; spores 20 to 22 by 11 to 12 μ obtuse, thickest toward the base, black; basidia 30 μ high, disposed regularly over the hymenium, 15 to 20 μ apart; stipe 10 cm. or less high, 1 to 4 mm. thick, equal, straight, smooth, hollow.

Manila, on horse manure and rotten leaves.

Related to *C. plicatilis* (Curt.) Fries and *C. sociatus* Fries but distinguished from both by the large spores, close gills and flakes on the young pileus.

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Panaeolus pseudopapilionaceus Copeland. Pileus 1.5 to 3 cm. wide, hemispherical, without umbo, whitish, not zonate, dry, naked, subfleshy; gills narrowly adnate; stipe changing from nearly white to black, 6 to 10 cm. high, 1.5 to 3 mm. thick in the middle, thicker toward both ends, white-powdery at the top, firm, with a narrow axial canal; spores 6.5 to 8 by 5 to 6 μ.

Manila, on manured ground.

Very like *P. papilionaceus* Fries, but differing in inequal stipe, less adnate gills, and especially in the shorter spores.

P. panalense Copeland. Pileus 7 cm. or less wide, conical, tawny, fleshy, the surface flocculose when dry, like blotting paper when wet; veil fugacious; gills deep, adnate, ashy-black; spores elliptical, 7.5 to 9 by 5.5 to 6.5 μ, appendiculate; stipe 12 cm. or less high, 1 cm. thick, equal, solid, brittle.

Capiz, Panay, on horse manure.

Agaricus (Psalliota) Boltoni Copeland. Pileus 10 to 15 cm. wide, passing from globose through cylindrical and conical to more or less plane, clothed with brown scales which are denser and larger toward the fuscous, fissured, plane or subumbonate disk, fleshy, the flesh white, well-flavored, almost odorless; gills numerous, crowded, free, 6 mm. deep, white when young, ultimately dark brown; spores 8 to 9 by 5 to 6 μ, with short basal appendage; stipe 8 to 15 cm. high, stout, with globose base, becoming hollow with age; annulus fixed, ample, persistent, declined, subentire.

Davao. A striking species, common in sunny pastures; named for Governor Bolton, of Davao.

A. (Psalliota) Merrillii Copeland. A large species, sometimes 10 cm. high and wide, almost without taste or odor; pileus naked or scaly, turning from white to brown, shining, subfleshy, truncate or with concave apex when young, sometimes umbonate in the middle of the depression, when old plane, with a horizontal, entire or incised border, 1 to 2 mm. broad, derived from the veil; gills about 250, crowded, 5 mm. deep, subacute at the margin, salmon-colored when the veil ruptures, finally turning black-brown; spores minute, 6 by 3.5 μ, uninucleate; veil rupturing late; annulus high up, white on both sides, floccose without, very lacerate, pendent; stipe somewhat contracted toward the top, abruptly enlarged at the base, solid or nearly so, whitish or turning brown outside and inside.

Manila, terrestrial under trees.

This species is near *A. platensis* Sacc. & Sydow. (*A. lepiotoideus* Speg.), but differs in its larger size, entire periphery, annulus white on both sides, and abruptly enlarged base. It is very variable in color and scaliness. Named for my colleague, Elmer D. Merrill.

A. (Psalliota) argyrostectus Copeland. Pileus 3.5 cm. wide, passing from conical to convexo-plane, shiny white, always naked, subfleshy, with unchanging gray flesh without odor, tasting like *A. campestris;* gills 3 mm. deep, free, obtuse at both ends, gray, turning dark; spores 5.5 to 6 by 4 to 4.5 μ, without guttules; stipe 3 to 4 cm. high, 4 to 8 mm. thick, firmly attached to the pileus, terete, scarcely enlarged downward, solid or nearly so; annulus membranous, pendent, early breaking up and disappearing.

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Photo by Copeland.

AGARICUS BOLTONI COPELAND.

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AGARICUS MERRILLII COPELAND.

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Davao, in sunny pastures, not common.

This species resembles *A. argenteus* Braendle and *A. argyropotamicus* Speg.; it differs from them in the pileus' being conical at first, the disk's shining like the periphery, unchanging flesh, and eguttulate spores.

A. (Psalliota) manilensis Copeland. Pileus convex, smooth, squamulose with disk flat and dark brown; toward the margin, where the scales are sparse, becoming white, subfleshy; gills free, rounded toward the stipe, turning from rose to dark-brown; spores about 7.5 by 4 μ, obtuse, oblique at the base; stipe 5 cm. high, 2.5 mm. thick, equal, naked, smooth, hardly solid; annulus fixed, entire, convex upward.

Manila, in lawns.

Resembles *A. haematospermus Bull.* and *A. dyspines* B. & Br.

A. (Psalliota) perfuscus Copeland. Entire fungus brown, darkening with age, odorless, with the flavor of *A. campestris;* pileus early expanded, 3 to 4 cm. wide, undulate, squamulose, subfleshy, disk slightly depressed, margin strongly but deciduously appendaged; gills free, close, obtuse at both ends, 4 mm. deep; spores elliptical, 6 to 6.5 by 4.5 μ, obscurely 1- or 2-guttulate; stipe 3 to 4 cm. high, 3 to 4 mm. thick equal, firm, naked, subhollow; annulus high up, fugacious.

Manila, subgregarious on manured ground in the old botanical garden.

Resembles *A. insinuatus* Cooke and *A. haematospermus* Bull.

Lepiota chlorospora Copeland. Pileus fleshy, passing from globose through campanulate to broadly conical, 8 cm. wide, 4 cm. high, the periphery sometimes explanate, disk with a brown, entire or fissured cap, periphery sparsely clothed with pale brown scales and fibers, white near the entire or subciliate margin; gills free, remote, 5 cm. long, 8 mm. deep, crowded, narrowed toward the stipe, white at first, turning a greenish-blue, their edges made of hyaline vesicles 25 to 35 by 20 μ; spores hyaline-green, 8 by 5 μ, smooth, short-stalked, each with a single large globule containing the green pigment; stipe 8 to 10 cm. high, 6 to 8 mm. thick, straight or crooked, knotted, firmly attached to the pileus, brown outside and inside, with white pith; annulus 1 cm. broad, conspicuous, fixed, persistent, split in its own plane, white above until discolored by the spores.

Manila, in lawns.

Distinguished from *L. esculenta* (Massee) Sacc. and Sydow by the brown scales and fixed annulus. Massee established the genus *Chlorophyllum* for these green-spored species; but it seems to me better to keep them in *Lepiota* and extend its characterization sufficiently to cover them. The spores are of the same color as those of *Aspergillus glaucus.*

L. manilensis Copeland. Flavor excellent, odor almost none; pileus 5 to 9 cm. wide, campanulate-conical, later flat, subumbonate, striate near the margin, the disk densely clothed with minute brown scales, which become sparse toward the margin; flesh whitish, unchanging; gills free, not attached to a collar, crowded, deep, whitish, subacute at both ends; spores variable, commonly 10 by 6 to 7 μ, the largest 13 to 15 by 7.5 to 9 μ, hyaline; stipe 10 cm. or less high, 1 cm. thick, firm, equal or somewhat

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thickened downward, with an axial canal, white or pale brown, naked; ring movable, or half-fixed, entire, with a dark brown margin.

Manila, around *Pithecolobium* and *Terminalia*.

L. elata Copeland. Odor and taste mild; pileus conical at first, but soon flat, 4 to 6 cm. wide, umbonate, fleshy, silky-squamulose about the disk, elsewhere naked, margin substriate, broadly reflexed when old, disk brownish, periphery white, turning dark red; gills also turning from white to dark wine-color, free, close, crowded, ventricose; spores 9 to 10 by 5 to 6 μ, hyaline, symmetrical; stipe 5 to 8 cm. high, 5 mm. thick at the middle, somewhat thickened downward, but not bulbous, naked, with an axial canal; ring midway, free, convex, narrow, entire, brown, fugacious, sometimes attached to the margin of the pileus.

Manila, in manured lawns.

Judging by the descriptions, this resembles *L. inebriata* B. and Br. and *L. microspila* Berk., both species Ceylonese.

L. candida Copeland. Odor wanting, taste mild; pileus 7 cm. wide, flat, strongly umbonate, dry, shining, almost naked, the disk fleshy, the margin thin, substriate, minutely crenate, the flesh unchanging; gills free, close, very crowded, lanceolate, subacute at both ends, thin, white; spores 9.5 by 6 μ, hyaline, guttulate, apiculate; stipe 15 cm. high, 5 mm. thick near the top, with a narrow axial hollow, much enlarged but not bulbous in the solid lower part, naked, shining white, deeply sunken into disk but not confluent with it; annulus high up, deciduous.

Manila, solitary in sunny grass.

Well characterized by the strongly fusiform lower third of the stipe.

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(Continued from second page of cover.)

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[1]The first four bulletins in the ornithological series were published by the Ethnological Survey under the title "Bulletins of the Philippine Museum." Future ornithological publications of the Government will appear under the title "Publications of the Bureau of Government Laboratories."

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